FINAL
RECORD OF DECISION
OPERABLE UNIT 3 SITE 16
CRASH CREW TRAINING PIT NO. 2
FORMER MARINE CORPS AIR STATION
EL TORO, CALIFORNIA

JULY 2003

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ATTACHMENTS

FIGURES

TABLES

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ACRONYMS/ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BCT	BRAC Cleanup Team
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	base realignment and closure
Cal. Civ. Code	*California Civil Code*
Cal. Code Regs.	*California Code of Regulations*
Cal/EPA	California Environmental Protection Agency
Cal. Health & Safety Code	*California Health and Safety Code*
CDMG	California Division of Mines and Geology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	*Code of Federal Regulations*
ch.	chapter
COC	chemical of concern
COPC	chemical of potential concern
CPT	cone penetrometer test
CSF	cancer slope factor
CTR	California Toxics Rule
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichloroethene
div.	division
DNAPL	dense nonaqueous-phase liquid
DoD	Department of Defense
DON	(United States) Department of the Navy
DTSC	(Cal/EPA) Department of Toxic Substances Control
EPC	exposure-point concentration
Fed. Reg.	*Federal Register*
FFA	Federal Facilities Agreement
FFS	focused feasibility study
Freon 113	1,1,2-trichloro-1,2,2-trifluoromethane
FS	feasibility study
gpm	gallons per minute

HHRA	human-health risk assessment
HI	hazard index
HQ	hazard quotient
IA	immunoassay analysis
IAS	initial assessment study
IRP	Installation Restoration Program
JEG	Jacobs Engineering Group Inc.
JMM	James M. Montgomery Engineers, Inc.
LGAC	liquid-phase granular activated carbon
LNAPL	light nonaqueous-phase liquid
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
MPE	multiphase extraction
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPW	net present worth
OCWD	Orange County Water District
O&M	operation and maintenance
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RACER	remedial action cost engineering requirements
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
Res.	Resolution
RFA	RCRA facility assessment
RfD	reference dose
RI	remedial investigation

ROD	record of decision
RWQCB	(California) Regional Water Quality Control Board
§	section
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SIPOA	site inspection plan of action
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWRCB	(California) State Water Resources Control Board
TAL	target analyte list
TCE	trichloroethene
TDS	total dissolved solids
tit.	title
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
UCL	upper confidence limit
U.S.C.	*United States Code*
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
WQCP	Water Quality Control Plan

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DECLARATION

DECLARATION

SITE NAME AND LOCATION

Former Marine Corps Air Station El Toro
Operable Unit 3 Site 16
Crash Crew Training Pit No. 2
Orange County, California

National Superfund Database Identification Number: CA6170023208

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit 3 Installation Restoration Program Site 16 at Former Marine Corps Air Station (MCAS) El Toro in Orange County, California. The document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record file for this site. A copy of the site-specific administrative record index is included as Attachment A.

The state of California (through the California Environmental Protection Agency Department of Toxic Substances Control and the Santa Ana Regional Water Quality Control Board) and the United States Environmental Protection Agency concur on the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the selected remedial action discussed in this Record of Decision (ROD), may present a current or potential threat to public health and welfare or the environment.

DESCRIPTION OF THE SELECTED REMEDY

Between 1972 and 1985, Site 16 was used by Former MCAS El Toro crash crews as a training area for firefighters. Contamination at the site originated from residual fuels and combustible fluids that were placed in fire-fighting pits, ignited, and extinguished using water or fire extinguishers during fire-fighting practice sessions. Contaminants within the unlined pits have infiltrated the soil and, eventually, migrated into the groundwater.

The primary medium of concern at Site 16 is groundwater, which is found at approximately 160 feet below ground surface (bgs). The only chemical of concern in groundwater is trichloroethene (TCE). TCE is present at concentrations above drinking water standards in a plume extending from approximately 200 feet upgradient of the main pit to approximately 330 feet downgradient of the main pit. Although petroleum hydrocarbons are present at Site 16, evaluation and cleanup of these contaminants is not addressed in this ROD. Petroleum hydrocarbons from fuels and oils burned and released at the site will be addressed in the Petroleum Corrective Action Program.

No further action is recommended for shallow soil (0 foot to 10 feet bgs) at Site 16. During the remedial investigation (RI), volatile organic compounds (VOCs) were reported in both soil and groundwater. The risk assessment performed during the RI showed that the contamination present in shallow soil did not present a significant risk to human health or the environment; however, contamination present in vadose zone soil (10 feet bgs to groundwater) was shown to have the potential to impact groundwater above drinking water standards.

Subsequent to the RI, a pilot study was performed to evaluate the site-specific effectiveness of multiphase extraction, a remedial technology considered for use at Site 16. During the study, the reported concentrations of VOCs in the vadose zone were reduced to levels that are not likely to impact groundwater above drinking water standards. The selected remedial action includes components that are designed to assure that VOCs in the vadose zone soil will not impact groundwater in the future.

The selected alternative for remediation of groundwater and vadose zone soil at Site 16, monitored natural attenuation with institutional controls, includes the following components.

- **Monitored natural attenuation (MNA).** Groundwater modeling performed during the feasibility study showed that concentrations of VOCs will decrease over time, through natural processes, to drinking water standards. Groundwater will be monitored to assure that contaminant concentrations are decreasing over time as expected.
- **Institutional controls.** Institutional controls will be used to protect groundwater monitoring wells, prevent use or disturbance of groundwater, and maintain a positive drainage over the main pit. These restrictions will be described in the preliminary and final remedial design reports to be developed and submitted to the Federal Facilities Agreement (FFA) signatories for review pursuant to the FFA. The remedial design reports will identify procedures to determine when cleanup standards have been met and the parties involved in this determination. The restrictions described in the remedial design reports will be removed when cleanup goals have been determined to be met.
- **Vadose zone monitoring.** Vadose zone monitoring will be performed to confirm the results from the multiphase extraction pilot test that showed that VOCs had been reduced to levels that are not likely to impact groundwater above drinking water standards.
- **Site grading.** The main pit will be graded (i.e., filled in with clean soil from an off-site source) to reduce the potential for infiltration by making the area higher than surrounding portions of the site. The grading will direct rainfall runoff away from the main pit toward storm drains located approximately 150 feet away.

Performance monitoring will continue as long as contamination remains above required cleanup levels. Typically, once cleanup levels have been achieved, monitoring is continued for a specified period (e.g., 1 to 3 years) to assure that concentration levels are stable and remain below target levels. Remedial design reports will describe the specific procedures that will be used to determine that the cleanup standards have been met.

The selected alternative of MNA was chosen based on the results of previous groundwater monitoring, although natural attenuation data were not collected. When an MNA evaluation has not been conducted, the United States Environmental Protection Agency recommends that a contingency remedy be developed. The contingency remedy for Site 16 consists of the following components.

- One extraction well would be used to achieve containment of the dissolved VOC plume downgradient of the source area.
- Extracted groundwater would be treated using liquid-phase granular activated carbon and discharged to an on-site storm drain.
- Monitoring would be performed to confirm that the remedy is effectively removing the VOCs in groundwater and containing the plume and to verify that the discharged groundwater is in compliance with the substantive requirements of National Pollutant Discharge Elimination System Permit No. CAG918001, General Groundwater Cleanup Permit.
- Institutional controls would be used to protect the extraction and groundwater monitoring wells and the associated piping and treatment system, prevent use of groundwater, maintain a positive drainage over the main pit, and allow the Department of the Navy and Federal Facility Agreement signatories access to the site to conduct or oversee monitoring and maintenance. These restrictions will be described in the preliminary and final remedial design reports to be developed and submitted to the FFA signatories for review pursuant to the FFA. The remedial design reports will identify procedures to determine when cleanup standards have been met and the parties involved in this determination. The restrictions described in the remedial design reports will be removed when cleanup goals have been determined to be met.

It is assumed that site grading and vadose zone monitoring will be complete prior to the potential implementation of the contingency remedy.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The remedy does not satisfy the statutory preference for remedies employing treatments that reduce toxicity, mobility, or volume as a principal element. The remedy was selected because modeling shows that the concentrations of VOCs present in groundwater will be reduced to drinking water standards in approximately 19 years without active treatment. In the interim, institutional controls will be used to prevent exposure to contaminated groundwater.

The effectiveness of the selected remedial action presented in this ROD will be reviewed, at a minimum, at 5-year intervals to assure that the remedy continues to adequately protect human health and the environment and is achieving cleanup goals. Once cleanup goals have been achieved, the 5-year review will no longer apply to this action because the concentration of TCE will be within health-based levels.

If, during the 5-year review or at any other time during the implementation of MNA, it is determined that the remedial action objectives are not being met, the Department of the Navy will evaluate whether potential new technologies could be effective or whether the contingency remedy described above should be implemented.

Any of the following criteria would trigger the need to evaluate whether the implementation of the contingency remedy or the use of new technologies is appropriate (determination will be made in consultation with the Base Realignment and Closure Cleanup Team).

- VOC groundwater concentration data indicate that VOCs have extended or will likely extend farther downgradient than the 1,300 feet from the main pit predicted by the groundwater model.
- VOC groundwater concentration data in the main pit area indicate an increasing trend, suggesting additional containment of the VOC plume is necessary.
- The trend of VOC concentrations in groundwater in the main pit area indicates that natural attenuation will not meet the remedial action objectives in the 19-year time span predicted by the groundwater model.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD:

- chemicals of concern and their respective concentrations (Section 5)
- baseline risk represented by chemicals of concern (Section 7)
- cleanup levels established for chemicals of concern and the basis for these levels (Section 8)
- how source materials constituting principal threats are addressed (Section 8)
- current and reasonably anticipated future land-use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Sections 6 and 7)
- potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 10)

- estimated capital, annual operation and maintenance, and total present worth costs, the discount rate, and the number of years over which the remedy cost estimates are projected (Section 10)
- key factors that led to selecting the remedy (Sections 8, 9, and 10)

Additional information can be found in the administrative record file for this site.

Signature: ______________________ Date: 22 July 2003
Mr. F. Andrew Piszkin
Base Closure and Realignment Environmental Coordinator
Former Marine Corps Air Station El Toro

Signature: ______________________ Date: 18 August 2003
Mr. Joel Jones, Chief
Federal Facilities Cleanup Branch
United States Environmental Protection Agency, Region 9

Signature: ______________________ Date: __________
Mr. John E. Scandura, Chief
Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Signature: ______________________ Date: __________
Mr. Gerald J. Thibeault
Executive Officer
Regional Water Quality Control Board, Santa Ana Region

DECISION SUMMARY

Section 1
SITE NAME, LOCATION, AND DESCRIPTION

This Record of Decision (ROD) presents the selected remedial action for Operable Unit (OU)-3 Installation Restoration Program (IRP) Site 16 at Former Marine Corps Air Station (MCAS) El Toro in Orange County, California. The National Superfund Database Identification Number for this facility is CA6170023208.

The document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for this site is based on information contained in the administrative record. A copy of the site-specific administrative record index for Site 16 is provided in Attachment A.

1.1 SITE NAME

This decision document addresses remediation of groundwater and vadose zone soil (10 feet below ground surface [bgs] to groundwater) at Site 16, Crash Crew Training Pit No. 2, at Former MCAS El Toro. Shallow soil (less than 10 feet bgs) at Site 16 has been investigated and is recommended for no further action.

1.2 SITE LOCATION

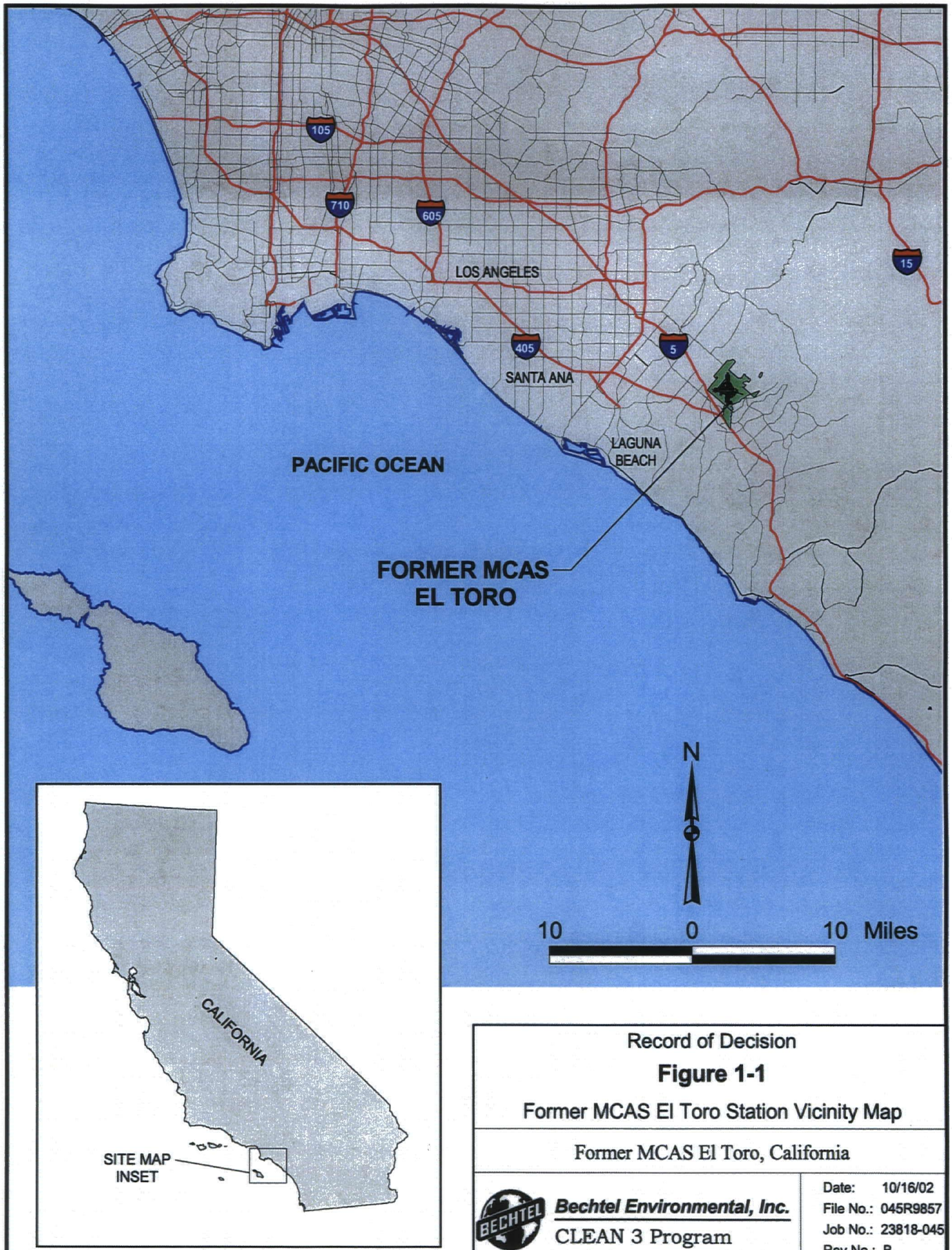
Former MCAS El Toro lies in a semiurban agricultural area of southern California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of the city of Laguna Beach (Figure 1-1). Land west and northwest of the Station is used for agriculture; land to the south and northeast is used mainly for commercial, light industrial, and residential purposes. Residential areas in the vicinity of Former MCAS El Toro include the cities of Lake Forest, Irvine, and Laguna Hills. Site 16 is in the northwest quadrant of the Station (Figure 1-2).

1.3 LEAD AND SUPPORT AGENCIES

Former MCAS El Toro is a federal facility and is on the National Priorities List (NPL) of the Superfund Program. The lead agency for remedial investigation and remedial action at this facility is the Department of the Navy (DON). Regulatory agencies providing support and oversight include the United States Environmental Protection Agency (U.S. EPA), the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), and the Santa Ana Regional Water Quality Control Board (RWQCB). The DON, U.S. EPA, DTSC, and RWQCB entered into a Federal Facilities Agreement (FFA) for Former MCAS El Toro in 1990.

1.4 SITE DESCRIPTION

Former MCAS El Toro was commissioned in 1943 as a Marine Corps pilot fleet-operation training facility. In 1950, the Station was selected for development as a master jet station and a permanent center for Marine Corps aviation on the west coast. Historical activities on the Station included aircraft maintenance and repair.



Record of Decision

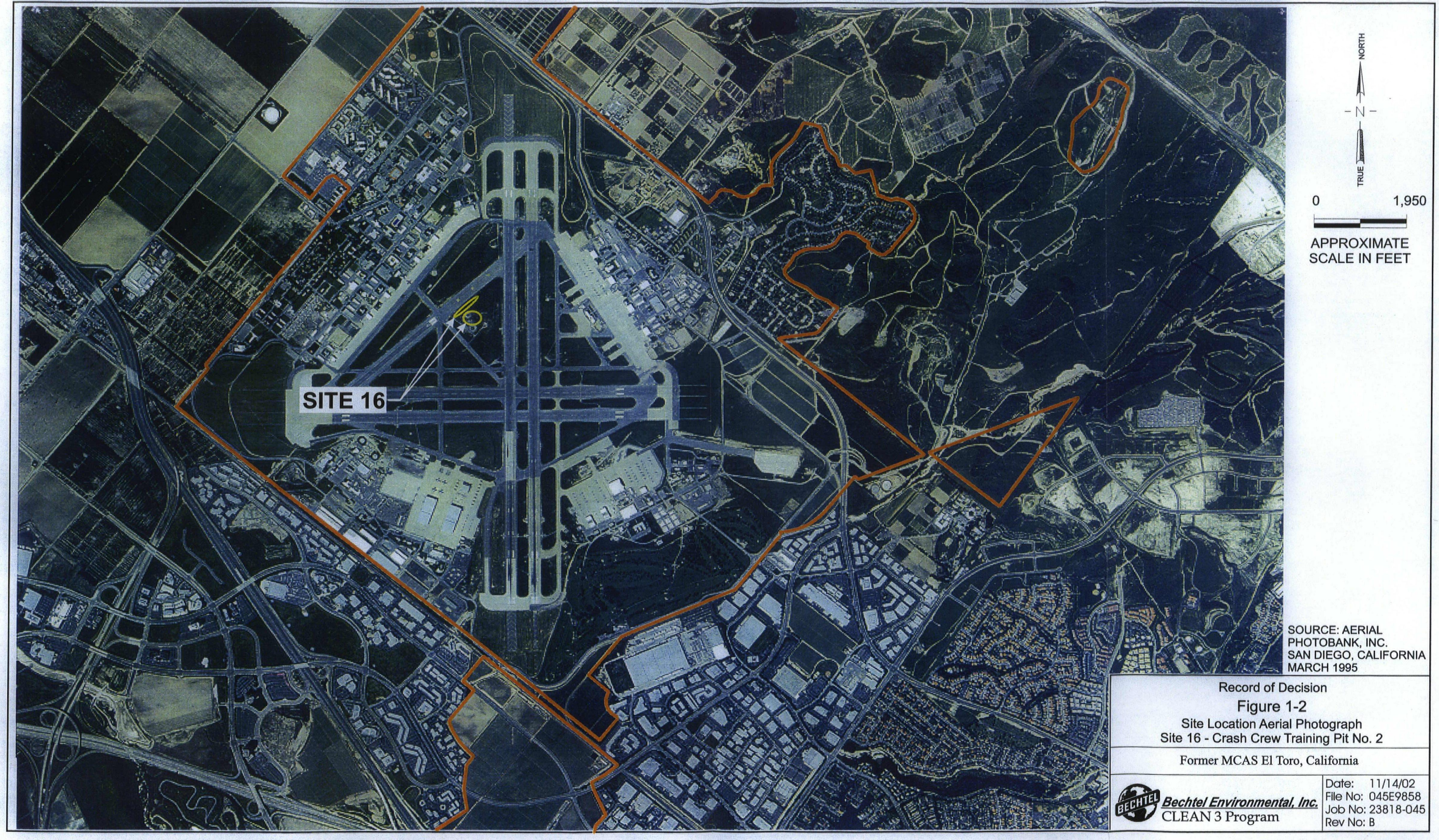
Figure 1-1

Former MCAS El Toro Station Vicinity Map

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 10/16/02
File No.: 045R9857
Job No.: 23818-045
Rev No.: B


SITE 16
NORTH
N
TRUE
0
1,950
APPROXIMATE
SCALE IN FEET
SOURCE: AERIAL
PHOTOBANK, INC.
SAN DIEGO, CALIFORNIA
MARCH 1995
Record of Decision
Figure 1-2
Site Location Aerial Photograph
Site 16 - Crash Crew Training Pit No. 2
Former MCAS El Toro, California
BECHTEL
Bechtel Environmental, Inc.
CLEAN 3 Program
Date: 11/14/02
File No: 045E9858
Job No: 23818-045
Rev No: B

The Station's mission has involved the operation and maintenance of military aircraft and ground-support equipment. To support the Station's mission, facility operations were expanded over the years to include runways, aircraft maintenance and training facilities, housing, shopping facilities, and other support facilities. During operations, Former MCAS El Toro occupied 4,738 acres of land, including 580 acres that were leased for commercial farming (DON 1999). Following closure of the Station, approximately 1,000 acres was transferred to the Federal Aviation Authority for use as a habitat reserve. Land uses around Former MCAS El Toro include residential, commercial, industrial, agricultural, and recreational uses.

Former MCAS El Toro ceased operations 02 July 1999. The Marine Corps' mission at the Station was incorporated primarily into MCAS Miramar operations in San Diego, California.

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Section 2
SITE HISTORY AND ENFORCEMENT ACTIVITIES

Past operations and practices at Former MCAS El Toro have contributed to soil and groundwater volatile organic compound (VOC) contamination. Industrial activities such as dust suppression with waste liquids, paint stripping, degreasing, vehicle and aircraft washing, and waste disposal practices involved the use of solvents containing VOCs such as trichloroethene (TCE). Waste solvents may have reached the surface or subsurface through leakage, runoff, storm drain flow, or direct application to the soil. At Site 16, wastes used as part of the fire-fighting activities are believed to be the source of TCE in groundwater. The precise origin, nature, and use of TCE released at the site and the quantities of individual releases are not documented. TCE usage at Former MCAS El Toro is believed to have been discontinued in the mid-1970s.

Environmental remediation activities at Former MCAS El Toro are performed under the IRP. The IRP was developed in 1980 by the United States Department of Defense (DoD) to comply with federal guidelines to manage and control contamination from past hazardous waste disposal actions (DON 1997).

2.1 INITIAL INVESTIGATIONS

The first indication of contamination in the vicinity of Former MCAS El Toro was noted during routine water-quality monitoring in 1985, when the Orange County Water District (OCWD) discovered TCE in groundwater at an irrigation well located approximately 3,000 feet downgradient of the Station.

In 1985, the DON began an initial assessment study (IAS) to locate potentially contaminated sites on the Station. This study was conducted for the Naval Facilities Engineering Command under the Navy Assessment and Control of Installation Pollutants Program, which was the DON version of the DoD IRP at that time. The IAS Report identified 17 sites as potential sources of contamination (Brown and Caldwell 1986). These sites were identified based on the results of record searches and employee interviews. The report recommended sampling locations and analytical parameters to confirm or negate suspected contamination at the sites.

In 1987, the Marine Corps contracted for a review of the IAS Report to produce a Site Inspection Plan of Action (SIPOA) (JMM 1988). In July 1987, while the SIPOA study was under way, RWQCB issued a cleanup and abatement order to the Marine Corps. This order required the Station to initiate a perimeter groundwater investigation for VOCs and submit a draft report. The SIPOA, released in August 1988, recommended 19 sites for study and amended the site sampling plans proposed in the IAS Report. This SIPOA served as the basis for a sampling and analysis plan for the sites designated for a remedial investigation (RI)/feasibility study (FS).

2.2 PHASE I AND PHASE II REMEDIAL INVESTIGATIONS

In June 1988, U.S. EPA recommended adding Former MCAS El Toro to the NPL of the Superfund Program because of VOC groundwater contamination at the Station boundary and in agricultural wells west of the Station. Former MCAS El Toro was added to the NPL on 15 February 1990. In October 1990, the Marine Corps/DON signed an FFA with U.S. EPA Region 9, California Department of Health Services, and RWQCB (FFA 1990).

The FFA is a cooperative agreement that:

- assures environmental impacts are investigated and appropriate response actions are taken to protect human health and the environment;
- establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions;
- facilitates cooperation, exchange of information, and participation of the parties; and
- assures adequate assessment, prompt notification, and coordination between federal and state agencies.

Implementation of the FFA is included as one of the responsibilities of the Base Realignment and Closure (BRAC) Cleanup Team (BCT). BCT's vision is to expedite restoration and reuse of Former MCAS El Toro. BCT's mission is fast-track remediation of Former MCAS El Toro to promote reuse and protect human health and the environment by working cooperatively with the community and stakeholders. The BCT consists of representatives from the DON Southwest Division Naval Facilities Engineering Command (SWDIV), U.S. EPA, DTSC, and RWQCB. The team was established to manage and coordinate environmental restoration and compliance programs related to the operational closure of Former MCAS El Toro by 1999.

In December 1989, the DON began to prepare a Phase I RI Work Plan and associated documents for Former MCAS El Toro. The DON reviewed available reports and other documents pertinent to past disposal practices at the Station and concluded that 22 IRP sites should be investigated (JEG 1993a). These sites were grouped into three OUs. OU-1 consisted of the regional VOC groundwater plume and included groundwater at Site 18 and throughout MCAS El Toro, including the area later defined as Site 24. OU-2 comprised the four landfill sites, Sites 2, 3, 5, and 17, and Site 10, the Petroleum Disposal Area (later moved to OU-3). The remaining 16 sites (Sites 1, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 19, 20, 21, and 22) were grouped together as OU-3. These sites were considered to be potential sources for a variety of contaminants. The principal objectives of the Phase I RI were to evaluate the source(s) of contamination in regional groundwater west of the Station and to determine whether contamination exists and is affecting the environment at sites within OU-2 and OU-3.

The results of the Phase I RI were documented in a draft Technical Memorandum issued in May 1993 (JEG 1993a), a draft RI Report for OU-1 issued in July 1994 (JEG 1994a), a final Soil Gas Survey Technical Memorandum issued in October 1994 (JEG 1994b), and a draft final interim RI/FS Report for OU-1 issued in August 1996 (JEG 1996). A variety of contaminants in groundwater, soil, surface water, and sediment at Former MCAS El Toro were identified during the Phase I RI. Contaminants in the soil and sediment consisted primarily of low concentrations of semivolatile organic compounds (SVOCs), petroleum hydrocarbons, pesticides, herbicides, and polychlorinated biphenyls

(JEG 1993a). During the Phase I RI, the source of contamination for regional groundwater was found to be in the southwest quadrant of the Station, but no specific source was identified. (It was later determined during the Phase II RI that Site 24 was the source of the regional groundwater contamination.) The sampling events yielded sufficient information to warrant conducting a preliminary risk assessment of contaminants at the sites for both groundwater and soil contamination. Results of the Phase I RI provided the primary data for the Phase II RI/FS.

In March 1993, Former MCAS El Toro was placed on the BRAC III list of military facilities considered for closure. Under the terms of the FFA, Station closure would not affect the DON's obligation to conduct the RI/FS or to comply with the other requirements of the FFA (FFA 1990).

Concurrent with the Phase I RI, the DON conducted a Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) at Former MCAS El Toro. The purpose of the RFA was to evaluate whether an additional 140 sites would require further investigation under the Phase II RI/FS Program. The final RFA Report was submitted in July 1993 (JEG 1993b). On the basis of an evaluation of the sampling results, further action was recommended for 25 solid waste management units/areas of concern. Site 23 (Wastewater Treatment Plant Sewer Lines) was evaluated in the RFA and recommended for no further action.

In 1994, interviews with both active and retired personnel from the Fuel Operations Division and the Facility Management Department (later known as the Installations Department) were held at Former MCAS El Toro (JEG 1994c). The objectives of the meeting were to confirm and supplement information obtained from past interviews and field investigations, to obtain a better understanding of current and historical operations at Former MCAS El Toro, and to identify new areas of potential environmental concern. Those interviewed had knowledge of operations and procedures for storage and disposal of hazardous materials and waste. The interview panel consisted of regulatory agency personnel, DON and Former MCAS El Toro personnel, and contractor personnel.

In July 1995, a final Work Plan for the Phase II RI/FS was issued (BNI 1995). This Work Plan presented an approach to conduct the Phase II RI at 24 IRP sites, including 2 newly identified sites, Site 24 (VOC Source Area) and Site 25 (Major Drainages). The objectives of the plan were to present a data quality objective-based sampling strategy to establish confidence that interpretations made from the data were correct and, ultimately, to collect sufficient information to support risk management decisions.

For the Phase II RI, the OU-3 sites were divided into OU-3A (Sites 4, 6, 8, 9, 10, 11, 12, 13, 15, 19, 20, 21, and 22) and OU-3B (Sites 1, 7, 14, and 16). The Phase II RI for the OU-3A sites and Site 16 was conducted from 1995 through 1997 (BNI 1997). The Phase II RI for OU-3B Sites 7 and 14 was conducted in 1999. A Phase II RI was initiated at Site 1 in 2002. Concurrent with the Phase II RI, the DON performed an evaluation of background concentrations of metals in soils and reference levels for pesticides and herbicides in soils (BNI 1996a). This enabled site-specific analytical results from soil sampling to be compared with background and reference levels to identify potential releases.

2.3 FEASIBILITY STUDIES

Remedial action objectives (RAOs) for soil and groundwater at OU-3 Site 16 were developed during the RI. The draft FS, issued in February 2000 (BNI 2000), identified several alternatives for remediation of these media. With the exception of the no action alternative, each of the alternatives used multiphase extraction (MPE), the presumptive remedy for sites with VOC contamination in soil and groundwater. Subsequent to issuance of the draft FS, an MPE pilot test was conducted at Site 16 to support the FS evaluations (BNI 2002a). The results (presented in Section 5.2.3.8) showed that MPE was very effective in remediating soil, but had little impact on groundwater contamination. As a result, the DON revised the FS and reissued it as a draft final focused feasibility study (FFS) in June 2001 and a final FFS in August 2002.

2.4 RECENT EVALUATIONS AND ASSESSMENTS

Subsequent to the Phase II RI, three groundwater evaluations were performed: an evaluation of metals (BNI 1999a), an evaluation of perchlorate (BNI 1999b, Earth Tech 2001a), and an evaluation of radionuclides (Earth Tech 2001b). The purpose of these evaluations was to determine whether the reported concentrations of metals, perchlorate, and radionuclides in groundwater at Former MCAS El Toro reflected ambient conditions or were the result of past Station activities.

The evaluation of metals showed that, even though the reported concentrations of some metals at various sites within Former MCAS El Toro exceeded maximum contaminant levels (MCLs), such conditions reflected ambient basewide groundwater quality conditions and were not the result of site-related contamination (BNI 1999b).

An evaluation of perchlorate was conducted in 1998 and 1999 to determine the concentration and distribution of perchlorate at the Station, evaluate probable sources, and assess the need for further evaluation based on the reported concentration. As a result of the sampling conducted at Site 16, perchlorate was not determined to be an issue. The perchlorate evaluation report recommended further monitoring at Site 1 and at landfill Sites 2, 3, 5, and 17 (Earth Tech 2001a). As a result, perchlorate is being evaluated as part of the basewide groundwater monitoring program and through additional site-specific investigations at Sites 1 and 2. The evaluation of radionuclides confirmed that radionuclides in groundwater at Former MCAS El Toro are naturally occurring and are not a result of historical activities conducted at the Station (Earth Tech 2001b).

From 1998 through 1999, the DON conducted a historical radiological assessment as part of the base closure process (Roy F. Weston 2000). A Historical Radiological Assessment Report summarizing the results of the assessment was issued in May 2000. The report recommended that a radiological survey be conducted at selected sites and buildings at Former MCAS El Toro; Site 16 was not one of these sites. The survey was completed in November 2001 and did not include Site 16. Results were summarized in a draft Radiological Release Report (Roy F. Weston 2002) that is expected to be finalized in 2003.

Table 2-1 summarizes the enforcement activities and environmental investigations that have occurred at Former MCAS El Toro.

Table 2-1
Summary of Environmental Investigations at Former MCAS El Toro

Date	Investigation/Activity	Objective	Summary of Findings
1985	IAS	Locate potentially contaminated sites using record searches and employee interviews.	Identified 17 sites as potential sources of contamination. Recommended sampling locations and analytical parameters to confirm the suspected contamination at the 17 sites.
1986	OCWD groundwater investigation	Investigate source of TCE found in agricultural well west of the Station.	After installing a series of monitoring wells and soil vapor probes and reviewing independent investigations, OCWD concluded that Former MCAS El Toro was the source of TCE contamination reported in groundwater downgradient of the Station.
1988	Site inspection plan of action	Review IAS findings.	Recommended that 19 sites be investigated. Amended the site sampling plans proposed in the IAS Report, which included one site (Site 18) intended to address the off-Station groundwater contaminant plume of VOCs.
1988	Perimeter study investigation	Address the RWQCB Santa Ana Region Cleanup and Abatement Order requiring investigation of the source of regional VOC groundwater contamination.	VOCs were reported in shallow groundwater near the southwestern boundary of the Station.
1989	Interim pump and treat system	Pump and treat VOC-contaminated groundwater from three extraction wells near the Station boundary.	Groundwater was extracted at a combined rate of 30 gallons per minute from three wells and treated with granular activated carbon. Extracted groundwater had concentrations of TCE and PCE from 10 to 160 and 25 to 100 parts per billion, respectively.
1989	Development of Phase I RI Work Plan and associated documents	Formulate work plan, field sampling plan, and other RI documents to direct the Phase I fieldwork.	The DON concluded that 22 sites would be investigated, and grouped the sites into three OUs.
1990	Superfund NPL	Identify sites with imminent risks to the public.	Former MCAS El Toro was added to the NPL for the Superfund Program because of VOC contamination at the Station boundary and in agricultural wells west of the Station boundary.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1993	Base Closure and Realignment Act	Identify sites for closure.	Former MCAS El Toro was placed on the BRAC III list. Under the terms of the FFA, Station closure would not affect the DON's obligation to conduct the RI/FS and comply with the other requirements of the FFA.
1993	Phase I RI	Make an initial determination regarding the existence and risks of contamination at sites in OU-1, OU-2, and OU-3.	Various contaminants in the groundwater, soil, surface water, and sediment were reported at Former MCAS El Toro. Soil and sediment contaminants were primarily SVOCs, petroleum hydrocarbons, pesticides, herbicides, and PCBs. The Phase I RI concluded that the source of contamination for regional groundwater was the southwest quadrant of the Station, but it did not indicate specific sources. A preliminary risk assessment was conducted for contaminants in both groundwater and soil at the sites.
1993	RCRA facility assessment	Evaluate whether an additional 140 sites would require further investigation under the Phase II RI/FS Program.	On the basis of the RCRA facility assessment results, further action was recommended for 25 SWMUs/AOCs. This action included additional subsurface investigation or other activities such as inspection of underground storage tanks, repair of cracks in concrete-paved areas, and excavation of contaminated soil. Of these 25 SWMUs/AOCs, further action was recommended for 2 sites under the Phase II RI/FS Program. Site 23 was investigated, and no further action was recommended.
1994	Phase I soil gas survey for Sites 24 and 25	Identify potential VOC sources at Sites 24 and 25.	The soil gas survey investigated soil conditions (generally 12 to 20 feet below ground surface). Elevated concentrations of VOCs were reported beneath the aircraft maintenance hangars (Buildings 296 and 297). TCE was the compound most frequently reported. Other VOCs reported included PCE, 1,1-dichloroethene, Freon 113, carbon tetrachloride, and chloroform.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1994	Interviews with active and retired personnel	Supplement and confirm information from past investigations and interviews, obtain a better understanding of current and historical operations, and identify new areas of potential environmental concern.	The interview panel provided information about types of operations that occurred on-Station and types of chemicals used in these operations.
1995	Development of final Work Plan for Phase II RI/FS and associated documents	Present an approach to conduct the Phase II RI at 24 sites using the U.S. EPA DQO process. Establish background concentrations of metals in soils. Establish a process to collect sufficient information to support decisions on risk management.	Established a DQO process for conducting RI/FS. Two new sites, Sites 24 and 25, were established for investigation in Phase II.
1996	Evaluation of background concentrations and reference levels in soil	Calculate background concentrations for metals in soil and reference levels for herbicides and pesticides in soil.	Background concentrations for metals and reference levels for herbicides were developed for comparison with site-specific analytical results in the RI to identify potential releases.
1996	Interim-action RI/FS for groundwater contamination designated as OU-1	Characterize groundwater contamination and evaluate potential actions to remediate VOC-contaminated groundwater in the principal aquifer.	A range of remedial alternatives was prepared. In June 2002, extraction and aboveground treatment was selected as the remedy for groundwater.
1996	RI for vadose zone and groundwater contamination at Site 24	Determine the nature and extent of VOC contamination at Site 24 and evaluate the human-health risk due to this contamination.	Soil and groundwater were investigated. The RI linked the groundwater hot spot identified during the Phase II RI with high concentrations of TCE in the vadose zone beneath Buildings 296 and 297.
1996	FS for vadose zone contamination at Site 24	Evaluate potential actions to remediate the VOC-contaminated soils at Site 24.	SVE is presented as the presumptive remedy most appropriate for remediation of contaminated soils.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1997	RI for OU-3A (including OU-3B Site 16) and Site 25	Determine the nature and extent of contamination at Sites 4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 19, 20, 21, 22, and 25, and evaluate the human-health risk due to this contamination.	Investigations revealed that contamination at Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22 is limited to shallow soils. Contamination at Site 25 is limited to sediment and surface water. In all cases, risks to human health are within the range generally considered allowable by U.S. EPA. A recommendation for no action was made to the BCT and was approved. An FS was recommended for OU-3B Site 16 and portions of Sites 8, 11, and 12.
1997	RI for landfill sites	Determine the nature and extent of contamination at Sites 2, 3, 5, and 17 and evaluate the human-health risk due to this contamination.	Air, soil, and groundwater were investigated. Risks at each site are driven by contamination in soil. At Site 2, VOCs are present in groundwater with concentrations above MCLs. Landfill gas controls are not necessary, and no principal threat wastes were found in soil gas.
1997	FS for landfill sites	Evaluate potential actions to remediate the landfills and allow site closure.	Capping, institutional controls, and monitoring are presented as the presumptive remedies most appropriate for remediating the landfills.
1997	FS for groundwater at Site 24	Evaluate potential actions to remediate VOC-contaminated groundwater at Site 24.	A range of remedial alternatives has been prepared. Extraction and above-ground treatment was selected as the remedy for groundwater in June 2002.
1997	Interim ROD for Site 24 vadose zone	Select an interim remedial alternative for soil at Site 24.	SVE was selected as the remedial alternative for soil at Site 24.
1997	ROD for OU-2A Site 25 and OU-3A no action sites	Select a remedial alternative for Site 25 and selected OU-3A sites.	No action was selected for Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25.
1998	FS for OU-3A Sites 8, 11, and 12	Evaluate potential actions to remediate contaminated soil.	Excavation and removal are presented as the actions most appropriate for remediating contaminated soil at portions of Sites 8, 11, and 12. Other portions of these sites do not require further action.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1998	Evaluation of metals in groundwater	Evaluate whether reported concentrations of metals in groundwater reflect ambient conditions or are the result of anthropogenic sources associated with historical station operations.	Although concentrations of some metals at various sites at Former MCAS El Toro exceed MCLs, such conditions are characteristic of basinwide groundwater quality conditions and are not indicative of site-related contamination.
1998–1999	Evaluation of perchlorate in groundwater	Evaluate whether reported concentrations of perchlorate in groundwater reflect ambient conditions or are the result of past Station operations.	Based on results from the evaluation, further monitoring was recommended at Site 1; landfill Sites 2, 3, 5, and 17; and other wells where perchlorate was reported.
1999	Continuation of RI for OU-3B Sites 7 and 14	Determine the nature and extent of contamination at Sites 7 and 14 and evaluate the human-health risk due to this contamination.	Investigations revealed that contamination at Sites 7 and 14 is limited to shallow soils. Human-health risks are within the range considered generally acceptable by U.S. EPA. A recommendation for no action was made to the BCT.
1999	ROD for Site 11	Select an alternative for remediating contaminated soil.	Excavation and removal are selected to remediate soil at Site 11.
1999	Soil gas survey at Site 16	Determine nature and extent of VOCs in soil gas.	Concentrations of total VOCs ranged from 828 to less than 1 µg/L. The highest concentrations of TCE were beneath the main pit. These concentrations increased with depth, with the highest concentrations reported at 150 feet bgs.
2000	Draft FS for OU-3B Site 16	Develop and evaluate remedial alternatives for soil and groundwater.	Eleven alternatives, including no action, were developed. Multiphase extraction (MPE) was the main component of each active alternative.
2000	Historical radiological assessment	Evaluate historical use, storage, and disposal of radiological materials and recommend follow-on investigations of potentially impacted areas.	The final Historical Radiological Assessment Report, dated May 2000, identified candidate sites for radiological surveys on the basis of historical information. Site 16 does not require further radiological investigation.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
2001	MPE pilot test for OU-3B Site 16	Evaluate the effectiveness of vacuum-enhanced extraction for remediating contaminated soil and groundwater.	The MPE pilot test was conducted from 17 October through 11 April 2001. Rebound testing performed in April 2001 and vadose zone confirmation sampling conducted in January 2002 showed that concentrations of VOCs in soil had been reduced to a level that would no longer impact groundwater above the MCLs. The pilot test had minimal impact on VOCs in groundwater.
2001	ROD for OU-3B Sites 7 and 14	Select remedial alternative for Sites 7 and 14.	No action was selected for Sites 7 and 14.
2000–2001	Radionuclide investigation of groundwater	Evaluate whether reported levels of radioactivity in groundwater reflect ambient conditions or are the result of past Station operations.	Laboratory analysis of radionuclide concentrations has shown that the reported levels of radionuclides are consistent with background. Therefore, radionuclides are not chemicals of concern in groundwater.
2001–2002	Radiological survey	Evaluate selected sites and buildings for radiological materials or contamination.	The radiological survey was conducted from June through November 2001. The historical assessment did not indicate that further investigation was required at Site 16. The final Radiological Release Report is scheduled to be issued in fall 2002.
2002	ROD for OU-1 Site 18 and OU-2A Site 24	Select a remedial alternative for groundwater at Sites 18 and 24.	Extraction and aboveground treatment was the selected alternative for remediation of groundwater. Treatment will occur at the Irvine Desalter Project Treatment Plant.
2002	FFS for OU-3B Site 16	Evaluate potential actions for contaminated soil and groundwater.	Groundwater alternatives included no action; MNA and institutional controls; downgradient extraction and hydraulic containment, monitoring, and institutional controls. Potential remedies also included monitoring to ensure that vadose zone concentrations of VOCs are not increasing. This is used to verify the effectiveness of the MPE pilot test in removing VOCs from soil. Soil grading was also proposed to reduce or prevent infiltration. This ROD presents the selected alternative.

(table continues)

Table 2-1 (continued)

Acronyms/Abbreviations:
AOC – area of concern
BCT – BRAC Cleanup Team
bgs – below ground surface
BRAC – Base Realignment and Closure
DON – Department of the Navy
DQO – data quality objective
FFA – Federal Facilities Agreement
FFS – focused feasibility study
FS – feasibility study
IAS – initial assessment study
µg/L – micrograms per liter
MCAS – Marine Corps Air Station
MCL – maximum contaminant level
MNA – monitored natural attenuation
MPE – multiphase extraction
NPL – National Priorities List
OCWD – Orange County Water District
OU – operable unit
PCB – polychlorinated biphenyl
PCE – tetrachloroethene
RCRA – Resource Conservation and Recovery Act
RI – remedial investigation
ROD – record of decision
RWQCB – (California) Regional Water Quality Control Board
SVE – soil vapor extraction
SVOC – semivolatile organic compound
SWMU – solid waste management unit
TCE – trichloroethene
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Section 3
HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan (BNI 1996b) was developed to document concerns identified during community interviews and to provide a detailed description of the community relations activities planned in response to information received from the community. The initial plan was prepared in 1991, revised in 1993 and 1996, and will be updated in 2002 to incorporate the most recent assessment of community issues, concerns, and information needs related to the ongoing environmental investigation and remediation program at Former MCAS El Toro.

The community relations program includes specific activities for obtaining community input and keeping the community informed. These activities include conducting interviews, holding public meetings, issuing fact sheets to provide updates on remediation activities, maintaining an information repository where the public can access technical documents and program information, disseminating information to local and regional media, and making presentations to local groups.

Community members and local governmental agencies have also participated in planning for the reuse of Former MCAS El Toro through development of the Community Reuse Plan (P&D Consultants Team 1996).

3.1 RESTORATION ADVISORY BOARD

In 1994, with the establishment of the Restoration Advisory Board (RAB), individuals from local communities began to play an increasingly significant role in the environmental restoration process. Original membership in the RAB, which was solicited by the Marine Corps and the DON through newspaper notices, exceeded 50 individuals, including business and homeowners' representatives, interested residents, local elected officials, and regulatory agency staff.

Currently, the RAB is composed of 28 registered members. Twelve RAB members are community members or private citizens. The remaining 16 RAB members are representatives from various government agencies. RAB meetings occur every 2 months, are open to the public, and include interested representatives from the DON, city and county offices, and regulatory agencies. Meetings are held in the evening from 6:30 to 9 p.m. at the Irvine City Hall, Conference and Training Center. By sharing information from the regular meetings with the groups they represent, RAB members help increase awareness of the IRP process. In addition, members of the public may contact RAB members to obtain information or express concerns to be discussed at subsequent RAB meetings.

Copies of RAB meeting minutes are available at the MCAS El Toro information repository, located at the Heritage Park Regional Library, 14361 Yale Avenue, Irvine, California; (949) 551-7151. RAB meeting minutes are also located on the Navy's SWDIV environmental website:

http://www.efdsw.navfac.navy.mil/environmental/envhome.htm

OU-3 Site 16 has been discussed at several RAB meetings. The most recent presentation on Site 16 was an update on the MPE pilot study that was under way at OU-3 Site 16. The presentation was given on 29 November 2000.

3.2 PUBLIC MAILINGS

Public mailings, including information updates, fact sheets, and proposed plans, have been used to assure an even broader dissemination of information within the local community (Table 3-1). The first information update announcing the IRP process at Former MCAS El Toro was delivered in November 1991 to area residents and mailed to city, state, and federal officials; agencies; local groups; and individuals identified in the Community Relations Plan. As significant remediation milestones occurred, subsequent fact sheets were mailed to the community. These publications have included information concerning the status of site investigations, the upcoming remedy selection process, ways the public can participate in the investigation and remediation of Former MCAS El Toro, and the availability of the administrative record for review.

Proposed plans are summaries of remedial alternatives proposed for a site or group of sites. The plan describes each of the alternatives, evaluates each alternative against nine criteria, and identifies the preferred alternative. The proposed plan is issued to the public before a public comment period to provide information and solicit public input on the potential remedial options that underwent detailed evaluation. Once the public comment period closes, the comments are compiled, reviewed by the BCT, and used to refine the remedial action. The final decision and response to comments (known as a Responsiveness Summary) are presented in a ROD.

To reach as many community members as possible, the updates, fact sheets, and proposed plans are mailed to approximately 600 households, businesses, public officials, and agencies. Copies are also made available at the information repository at Heritage Park Regional Library and in the administrative record file at Former MCAS El Toro.

3.3 COMMUNITY PARTICIPATION FOR OPERABLE UNIT 3 SITE 16

The draft final RI Report for Site 16 was issued in March 1997. The final FFS Report was issued in September 2002. The Proposed Plan for Site 16 was distributed to community members on the Former MCAS El Toro project mailing list in September 2002. The Proposed Plan, final FFS, and the RI Report were also made available to the public at the information repository maintained at the Heritage Park Regional Library in Irvine, California. The notice of availability for these documents was published in the *Orange County Register* and the *Los Angeles Times (Orange County Edition)* approximately 1 week before the start of the public comment period on the proposed plan. The notice also announced the availability of the administrative record file for review. Complete administrative record files are available at the SWDIV office, 1220 Pacific Highway, San Diego, California, and at Former MCAS El Toro. A partial record file is available for review at the Heritage Park Regional Library. The library also

Table 3-1
Summary of Former MCAS El Toro Updates, Fact Sheets, and Proposed Plans

Fact Sheet Number	Date	Summary of Contents
—*	11/91	Information update/IRP process
—	12/92	Information update
1	12/93	Phase II RI results
2	12/93	RAB formation
3	07/95	Information update/Tank 398
4	10/95	Information update/engineering evaluation/cost analysis
5	11/95	MCAS El Toro Building 673-T3 Certification for Closure
6	04/96	Looking back–moving forward update on IRP progress
7	12/96	Groundwater remediation OU-1 and OU-2A
—	04/97	Proposed Plan for Site 24 Vadose Zone
—	06/97	Proposed Plan for No Action Sites
—	05/98	Proposed Plan for Landfill Sites 2, 3, 5, and 17
8	02/99	SVE design at Site 24
—	05/99	Proposed Plan for OU-3A Sites 8, 11, and 12
—	09/00	Proposed Plan for OU-3B No Action Sites 7 and 14
—	11/01	Proposed Plan for OU-1 Site 18 and OU-2A Site 24
—	09/02	Proposed Plan for OU-3B Site 16

Note:
* dash indicates fact sheet unnumbered

Acronyms/Abbreviations:
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station
OU – operable unit
RAB – Restoration Advisory Board
RI – remedial investigation
SVE – soil vapor extraction

contains a complete index of the administrative record file along with information on how to access the complete file at Former MCAS El Toro.

A public comment period for the Proposed Plan for Site 16 was held from 17 September to 17 October 2002. In addition, a public meeting was held on 25 September 2002. This meeting was announced in the *Orange County Register* and *Los Angeles Times (Orange County Edition)* on both 17 and 19 September 2002.

At the public meeting, representatives from the DON and environmental regulatory agencies presented information about site conditions and the remedial alternatives under consideration. A court reporter recorded public comments. Comment forms were provided to encourage submittal of written comments during or after the meeting. Response to comments received during the public comment period are included in the Responsiveness Summary, which is part of this ROD. A copy of the transcript from the public meeting is also included in this ROD as Attachment B.

Section 4
SCOPE AND ROLE OF OPERABLE UNIT

Twenty-five IRP sites have been investigated at Former MCAS El Toro. Twenty-four of these sites are grouped into three OUs. Site 23 was evaluated in an RFA under the FFA and, as a result, was eliminated as an environmental concern. OU-1 encompasses Site 18 (Regional VOC Groundwater Plume). OU-2 is subdivided into OU-2A, -2B, and -2C. OU-3 is subdivided into OU-3A and -3B.

OU-1 Site 18 was addressed in a ROD that was issued to the public in May 2002 and signed in June 2002 (SWDIV 2002).

OU-2A, which includes Site 24 (VOC Source Area) and Site 25 (Major Drainages), was defined to address the potential sources of regional groundwater contamination. After the Phase II RI showed that Site 25 was not a source of regional groundwater contamination, the site was recommended for no action and included with several OU-3 sites in a no action ROD that was signed in September 1997 (SWDIV 1997a).

OU-2A Site 24 was investigated and found to contain two contaminated media, soil and groundwater. Remediation of soil at Site 24 was addressed in an interim ROD that was signed in September 1997 (SWDIV 1997b). The interim ROD selected soil vapor extraction as the remedy for VOC-contaminated soil. The ROD was interim because it did not address groundwater at Site 24 and because the DON agreed to reevaluate cleanup levels for soil in the final ROD, which will be issued later. A ROD documenting the selected remedy for groundwater at Sites 18 and 24 was finalized in June 2002.

OU-2B encompasses Sites 2 and 17, and OU-2C encompasses Sites 3 and 5. Sites 2, 3, 5, and 17 are generally referred to as "the landfill sites." Sites 2 and 17 were addressed in an interim ROD that was issued to the public in April 2000 and signed in July 2000 (SWDIV 2000). The ROD was interim because it presented the selected remedial action for only soil at Site 2 and for soil and groundwater at Site 17 and did not contain the results of a radiological survey planned to be conducted at the sites. Remediation of groundwater at Site 2 will be addressed in the final ROD that is expected to be issued to the public in 2003. The final ROD will also summarize the results of the survey and address radiological contamination, if any, at both Sites 2 and 17. Sites 3 and 5 will be addressed in an OU-2C ROD that is expected to be issued to the public in 2003.

OU-3 was defined to address the remaining IRP sites at Former MCAS El Toro. Of the 13 sites in OU-3A, 10 (Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22) were investigated, found to present no unacceptable risks to human health or the environment, and recommended for no action. These sites were addressed along with Site 25 in the final no action ROD (SWDIV 1997a). OU-3A Site 11 was addressed in a ROD, signed in September 1999, that documented the selected action remedy for Units 1 and 2 and included no further action for Unit 3 (SWDIV 1999). OU-3B Sites 7 and 14 were addressed in a no action ROD that was signed in June 2001 (SWDIV 2001). OU-3B Site 16 is addressed in this ROD. The remaining OU-3A sites (Sites 8 and 12) and OU-3B Site 1 are currently being evaluated.

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Section 5
SUMMARY OF SITE CHARACTERISTICS

This section describes the regional and site-specific characteristics of Former MCAS El Toro, provides a brief history of the source of contamination at Site 16, summarizes previous sampling performed at the site, and presents tables summarizing site-specific sampling results. Section 5 concludes with a discussion of current and potential future migration pathways for chemicals of potential concern (COPCs) at Site 16. Discussions of sampling locations and methodologies, compounds reported at each site, and the nature and extent of contamination appear in the Phase II RI Report for OU-3A (BNI 1997) and the FFS Report for Site 16 (BNI 2002b).

The nature and extent of contamination at Site 16 is based on Phase I and Phase II RI data presented in the Phase II RI Report (BNI 1997), data collected during the pre-FS report sampling, and data from the MPE pilot study conducted subsequent to the RI. The Phase II investigation consisted of a review of data gathered previously and additional sampling and analysis designed to fill in data gaps from the Phase I investigation and to provide information necessary to conduct a baseline human-health risk assessment (HHRA). The soil gas survey conducted during the pre-FS report sampling delineated the nature and extent of VOC contamination in soil gas before remediation. The pilot study evaluated the effectiveness of MPE in remediating contaminated vadose zone soil and groundwater at Site 16. MPE was successful in reducing VOC concentrations in soil, but it was not effective in treating groundwater.

5.1 REGIONAL CHARACTERISTICS

Former MCAS El Toro is situated on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived mainly from the Santa Ana Mountains. The Tustin Plain, bounded on the north and east by the Santa Ana Mountains and on the south by the San Joaquin Hills, is at the southeast end of the Los Angeles Basin, a large sedimentary basin in the Peninsular Ranges Geologic Province. The elevation at Former MCAS El Toro ranges from 215 feet above mean sea level (MSL) in the western portion to approximately 800 feet above MSL in the eastern portion.

5.1.1 Geology and Hydrogeology

The Tustin Plain is a broad basin composed of Quaternary marine and alluvial sediments deposited on Tertiary marine sedimentary bedrock (Fife 1974). The Quaternary deposits are generally less consolidated and more permeable than the bedrock. The Tustin Plain is bound by bedrock exposed in the Santa Ana Mountains to the north and east and in the San Joaquin Hills to the south.

The Tertiary bedrock consists of semiconsolidated marine sandstones, siltstones, and conglomerates of the Sespe, Vaqueros, Topanga, Capistrano, Niguel, and Fernando Formations (CDMG 1981). The lower-Pliocene Fernando Formation forms the base of the water-bearing units at Former MCAS El Toro (Herndon and Reilly 1989). The Fernando Formation is interbedded with marine clayey and sandy siltstones of the Capistrano and Niguel Formations west of Former MCAS El Toro (JMM 1988).

Pleistocene sediments, predominantly composed of interlayered fine-grained lagoonal and nearshore marine deposits, unconformably overlie the Tertiary sedimentary bedrock (Singer 1973). These deeper Quaternary sediments may be equivalent to the lower Pleistocene San Pedro Formation, which consists of semiconsolidated silts, clays, and sands with interbedded limestone.

Conformably overlying the Pleistocene sediments are Holocene materials consisting of isolated coarse-grained, stream-channel deposits within fine-grained overbank deposits. These Holocene sediments were deposited as alluvium and range in thickness up to 300 feet (Herndon and Reilly 1989).

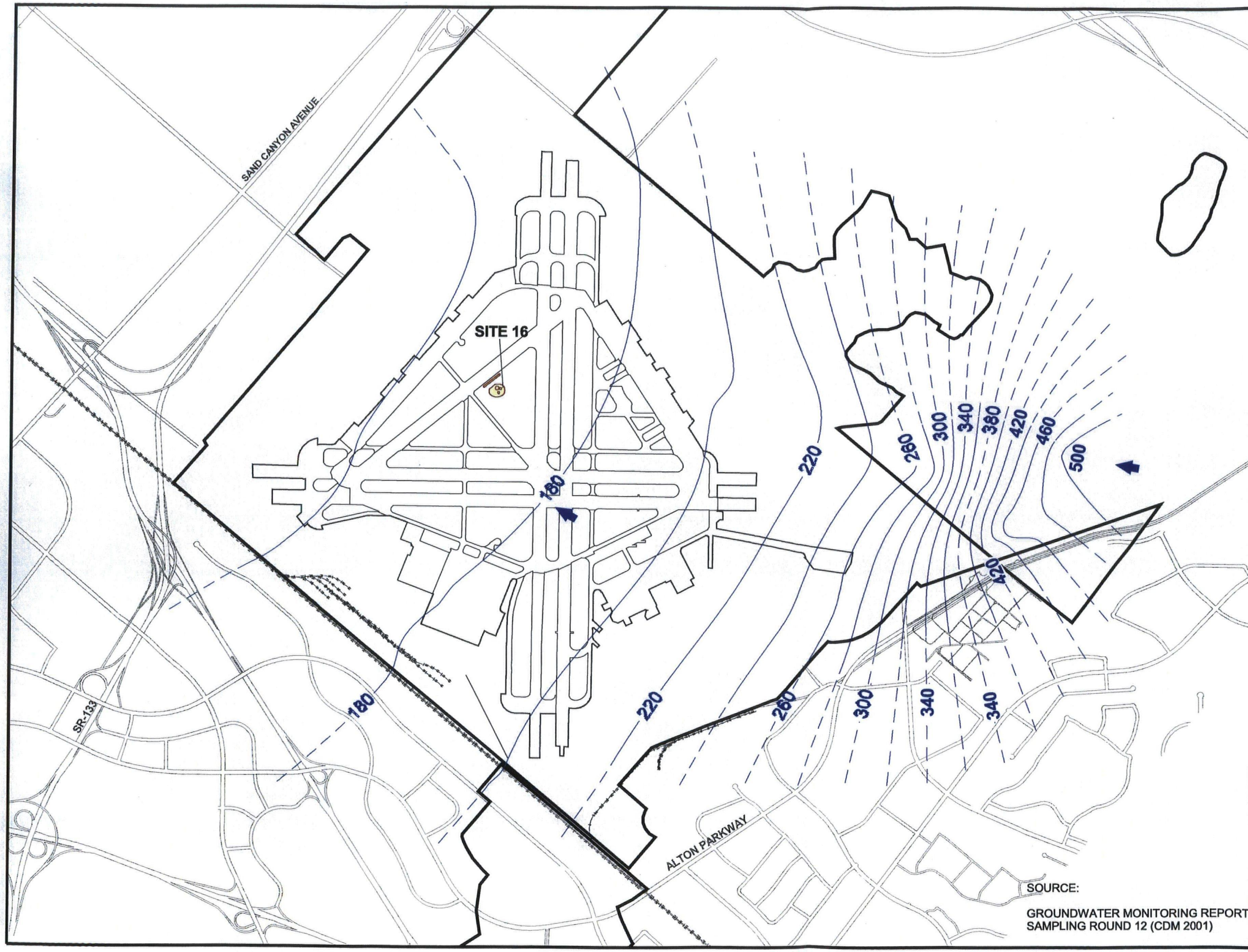
Former MCAS El Toro lies within and immediately adjacent to the Irvine Forebay I Groundwater Subbasin (Irvine Subbasin). The Irvine Subbasin has been designated by RWQCB as a public water supply source (RWQCB 1995). Regional aquifer systems in the Irvine Subbasin have been described as a series of discontinuous lenses of clayey sands and gravels contained within an assemblage of sandy clay and silt. These aquifer systems are within the less consolidated and more permeable Quaternary sedimentary deposits. Regionally, the stratigraphic units within the aquifers are considered to be laterally extensive and representative of two homogeneous systems, a shallow aquifer and a deeper zone (referred to as the "principal aquifer"). An intervening horizon of fine-grained materials hydraulically separates the shallow and deep aquifers but appears to allow leakage in some locations.

The depth to shallow groundwater beneath Former MCAS El Toro ranges from approximately 45 to 60 feet bgs in the foothills, to approximately 85 feet bgs along the southwest boundary, to greater than 240 feet bgs along Irvine Boulevard (JEG 1993a). Groundwater in the shallow aquifer flows toward the northwest at gradients ranging from 0.005 to 0.025 feet/foot (Figure 5-1). The hydraulic gradient has been influenced strongly by the pumping of irrigation wells west of Former MCAS El Toro. Average linear groundwater flow velocities are reported to range from 0.02 to 1.9 feet per day (JMM 1990).

5.1.2 Surface Hydrology

Surface drainage near Former MCAS El Toro generally flows southwest, following the slope of the land perpendicular to the trend of the Santa Ana Mountains. Several washes originate in the hills to the northeast and control flow through or adjacent to the Station en route to San Diego Creek. Off-Station drainage from the hills and upgradient irrigated farmland combines with Station runoff and flows into four main drainage channels. Three of these drainage channels are contiguous with natural washes that originate in the Santa Ana Mountains: Borrego Canyon, Agua Chinon, and Bee Canyon. The fourth drainage is Marshburn Channel (Figure 5-2).

Borrego Canyon Wash flows along the southeast boundary of Former MCAS El Toro. The wash is unlined in the Santa Ana Mountains and unlined downstream of Irvine Boulevard. Borrego Canyon Wash crosses the southern corner of the Station and joins Agua Chinon Wash about 1/4 mile downstream of the Station boundary.



SOURCE:

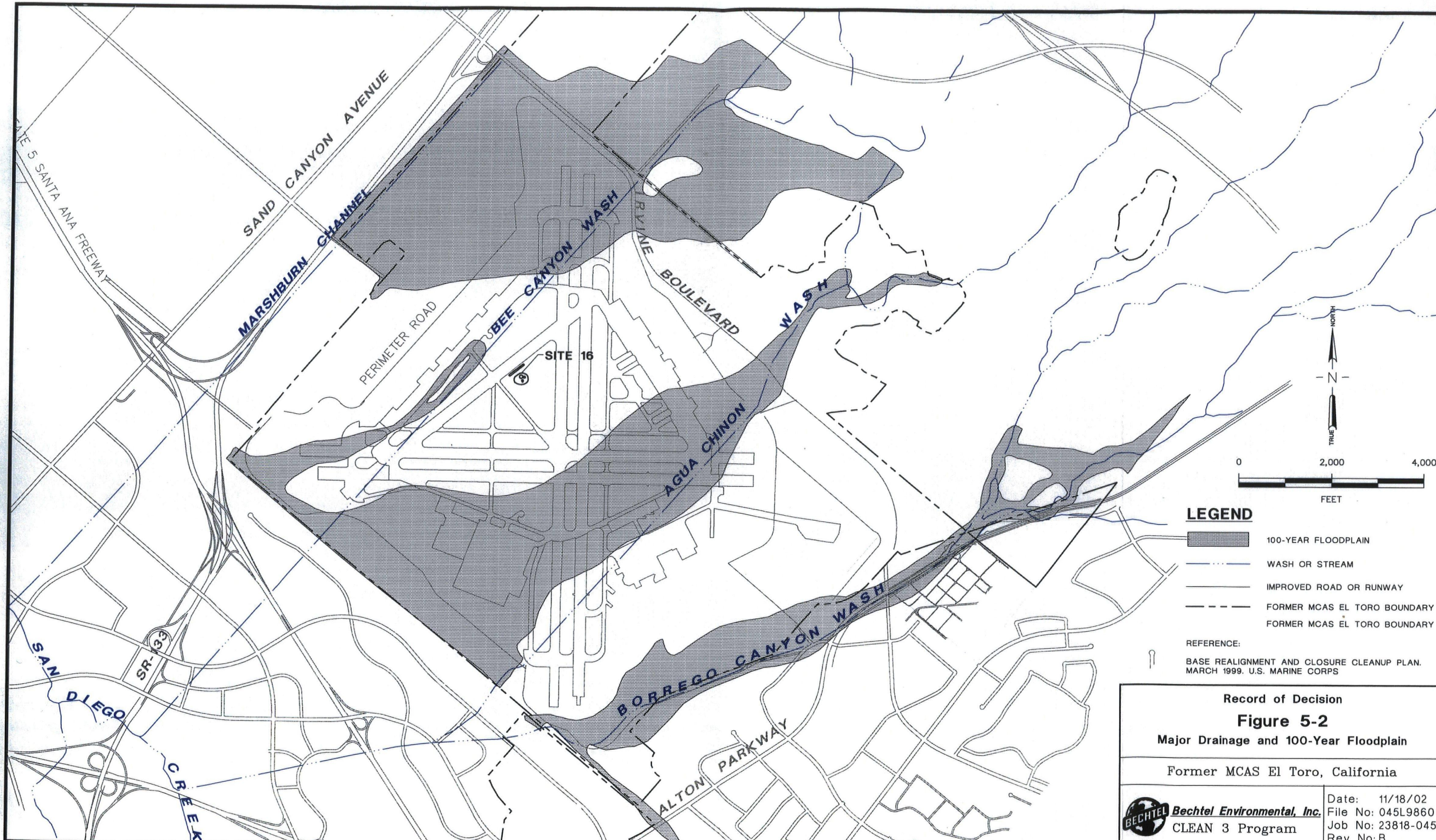
GROUNDWATER MONITORING REPORT
SAMPLING ROUND 12 (CDM 2001)

Record of Decision
Figure 5-1
Groundwater Gradients in the Shallow Aquifer

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No.: 045L9859
Job No.: 23818-045
Rev No.: C



Record of Decision

Figure 5-2

Major Drainage and 100-Year Floodplain

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045L9860
Job No: 23818-045
Rev No: B

Both Agua Chinon and Bee Canyon Washes cross the central portion of Former MCAS El Toro and receive on-Station runoff mainly through storm sewers. These washes are contained in culverts along most of their pathways across the Station. Both washes are unlined along several hundred feet at the southwest edge of the Station and are lined again in a culvert beneath the Irvine Spectrum development adjacent to the southwestern boundary of the Station. Marshburn Channel is a lined drainage channel that runs along the northwestern boundary of Former MCAS El Toro. The channel receives runoff from the western part of the Station. All of the drainages ultimately discharge into San Diego Creek.

The MCAS El Toro Master Plan indicates that much of the Station lies within a 100-year floodplain. Existing drainage systems were developed for agricultural use, not for the increased flows generated by the urban development now surrounding the Station. Approximately 15 acres of agricultural lease land was flooded and crops were destroyed during a storm on 29 November 1997. The area included in the 100-year floodplain is shown on Figure 5-2.

5.1.3 Climate

The mean average rainfall at Former MCAS El Toro is 12.2 inches, most of which occurs from November through April (JEG 1993a). Net infiltration from precipitation is estimated to be less than 2 inches per year (BNI 2000a) because of the low average annual rainfall and high evapotranspiration rates.

From March through October, the prevailing wind is from the west, averaging 6 knots. From November through February, the prevailing wind is from the east, averaging 4 knots. Strong, dry, gusty, offshore winds (locally known as "Santa Ana winds") are common during late fall and winter. The typically dry conditions and persistent winds may cause light to moderate wind erosion.

5.2 SITE 16 CHARACTERISTICS

Site 16, Crash Crew Training Pit No. 2, is located in the northwest quadrant of Former MCAS El Toro, in the center of the airfield at an elevation of approximately 320 feet above MSL (Figure 1-2). The terrain in the immediate vicinity of the site is relatively flat, and grades are approximately 0 to 3 percent. The site consists of three units.

Unit 1, Pits Perimeter Area (Figure 5-3), is an approximately 320- by 260-foot oval-shaped area comprising a buffer zone surrounding three pits that were used for firefighter training exercises. During the operational life of Site 16, this area was regularly tilled as a fire-control measure.

Unit 2, Main Fire-Fighting Pits, consists of three unlined earthen pits situated within the boundary of Unit 1. The largest pit (Figure 5-3), which was used for most of the training exercises and is still present at the site, is roughly circular (approximately 67 feet in diameter), and 2 to 3 feet deep. The residual fluids pit, located about 40 feet south of the main pit and connected to it by a buried pipe, is approximately 12 feet wide, 35 feet long, and 4 to 5 feet deep (JEG 1993a). The smaller third pit, roughly 10 feet by 3 feet, was used for training with handheld fire extinguishers (JEG 1993a). The pits have not been used since 1985, and the residual fluids and handheld fire-fighting training pits have been filled to the surrounding grade (Figure 5-4).

Unit 3, Drainage Channel, is a low drainage swale located northwest of the pits. It slopes toward and terminates at a storm drain inlet near the intersection of El Toro Boulevard and closed Runway 21. This unit was recommended for no further action in the RI Report for Site 16 (BNI 1997).

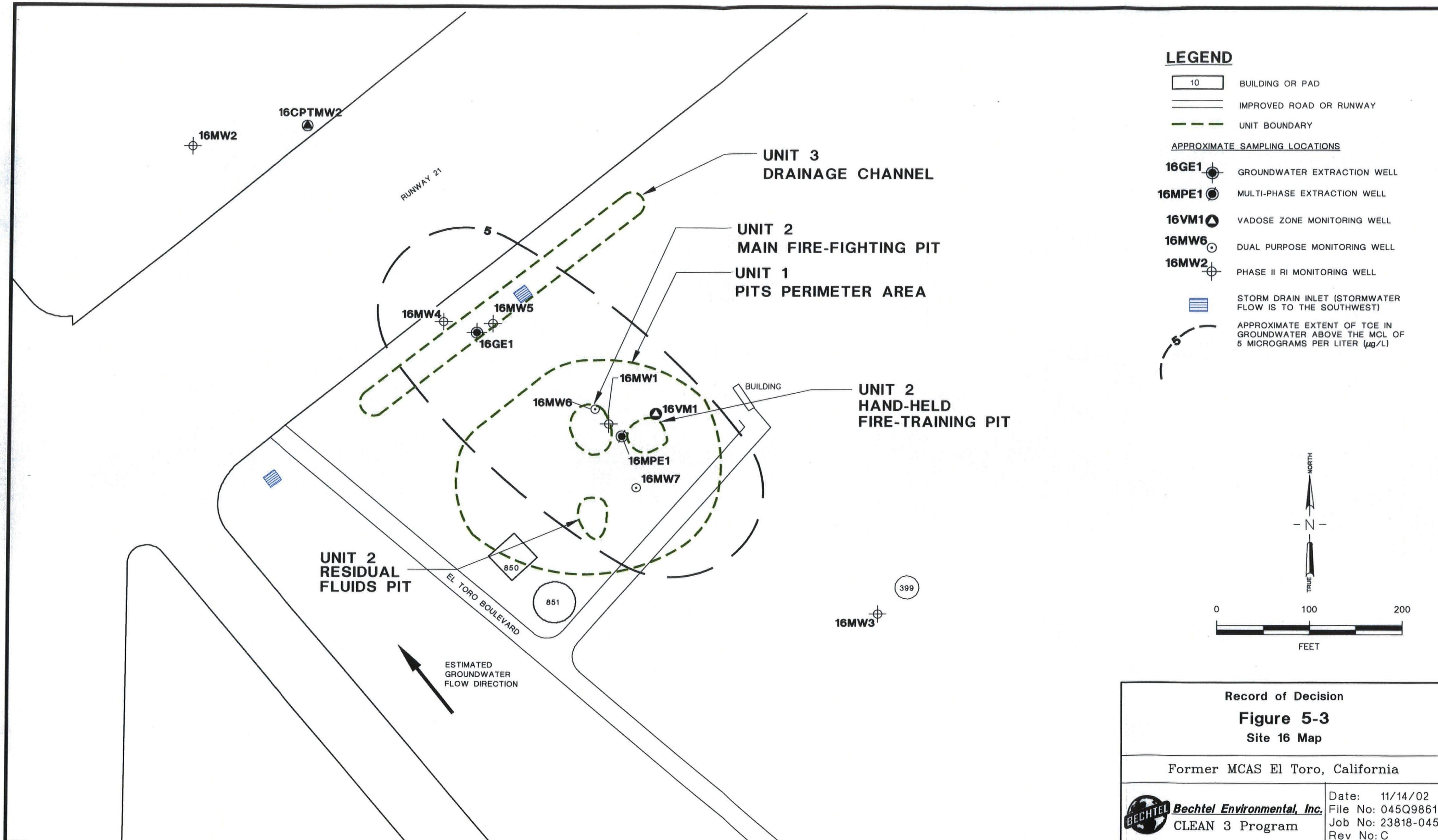
The ground surface at Site 16 consists of bare soil with partial vegetation cover in the area surrounding the main burn pit and along the drainage ditch. The bottom of the burn pit itself is bare soil, discolored as a result of the historical activities at this site. The former residual fluids pit has been partially covered by the asphalt pavement surrounding the current concrete-lined crash crew training pits located immediately south of Site 16. Surface drainage from the site appears to flow northwest to a storm drain, which eventually discharges into Bee Canyon Wash (BNI 1997).

5.2.1 Geology and Hydrogeology

Lithologic data from the soil borings and cone penetrometer test (CPT) logs from Site 16 indicate that the alluvial sediments at this site consist of interbedded, lenticular strata composed of clay, silt, clayey to silty sand, and fine- to coarse-grained sand with traces of gravel. The gravel lenses within the sand and silt units are probably associated with stream channel deposits. The predominant lithologic types are silts, clays, and silty sand, with some sand. Soil in the area of Site 16 is classified as Sorrento loam (Wachtell 1978). This soil develops on nearly flat (0 to 2 percent slope) floodplain deposits like those present at Site 16. Sorrento loam is typically a well-drained soil characterized by slow surface runoff and a slight erosion hazard due to the nearly flat surfaces upon which it develops (Wachtell 1978). The shallow groundwater unit is present beneath Site 16 at a depth of approximately 160 feet bgs. Regional groundwater flow beneath Site 16 is generally to the west-northwest.

5.2.2 Site History

Site 16 was used by crash crews between 1972 and 1985 as a training area for firefighters. During training exercises, the main pit was filled with water and covered with various mixtures of residual fuels and other combustible fluids (e.g., jet propellant grade 5 fuel, aviation gasoline, crankcase oil, and other wastes). The mixtures were then ignited and extinguished by the firefighters. Water was used as the primary means of extinguishing the fires during the practice sessions in the main pit. The residual fluids pit, connected to the main pit by a buried pipe, served as a regulating and storage reservoir for the additional water applied to the main pit during each exercise. An estimated 275,000 gallons of residual fluids may have been placed in the three pits (Brown and Caldwell 1986).



Record of Decision

Figure 5-3

Site 16 Map

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/14/02
File No: 045Q9861
Job No: 23818-045
Rev No: C

NORTH
N
TRUE

0 330

APPROXIMATE SCALE IN FEET

SOURCE: AERIAL PHOTOBANK, INC.
SAN DIEGO, CALIFORNIA
DATE: 01/12/96

Record of Decision

Figure 5-4

Site Aerial Photograph (01/12/96)

Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/14/02
File No: 045E9862
Job No: 23818-045
Rev No: C

Prior to 1972, firefighter training exercises were conducted at Site 9 located in the southwest quadrant of the Station. The crash crew pits used after 1985, located immediately south of Site 16, consist of two concrete-lined pits surrounded by asphalt pavement (Figure 5-4).

5.2.3 Site Investigations

Investigations conducted at Site 16 include aerial photographic surveys, employee interviews, Phase I and Phase II RIs, pre-FS report sampling, and an MPE pilot test conducted in support of the FFS. Data collected during the Site 16 RIs included results of shallow and deeper subsurface soils investigations, groundwater investigations, aerial photograph reviews, and interviews with Former MCAS El Toro personnel.

5.2.3.1 PHASE I REMEDIAL INVESTIGATION

During the Phase I RI at Site 16, three units (referred to as a "stratum" during Phase I) were investigated, including the perimeter area, the main burn pit, and the drainage ditch (Figure 5-3) (BNI 1997). The following site-specific activities were conducted.

- Twenty-one surface and shallow (0 to 10 feet bgs) soil samples were collected from nine shallow boring locations within Site 16.
- Four surface and shallow soil samples were collected at two locations upgradient of the site.
- One 25-foot boring (16_25B212) and one 60-foot angle boring (16_AB213) were drilled, and three shallow and eight deeper subsurface (greater than 10 feet bgs) soil samples were collected from the two on-site locations.
- One on-site monitoring well (16_DBMW52) was drilled to approximately 225 feet bgs, installed, and sampled.
- One off-site upgradient monitoring well (16_UGMW33) was drilled to approximately 221 feet bgs, installed, and sampled.
- One off-site downgradient monitoring well (16_DGMW81) was drilled to approximately 227 feet bgs, installed, and sampled.
- Two shallow and nine deeper subsurface soil samples were collected from the borings for the three monitoring well locations.
- Groundwater samples were collected from each of the Site 16 monitoring wells after their completion and development.

Chemicals reported in soil included VOCs, SVOCs, diesel, gasoline, total recoverable petroleum hydrocarbons (TRPH), and metals. Chemicals identified in groundwater included VOCs, metals, and general chemistry parameters (chloride, nitrate/nitrite, and sulfate).

Analytical results for shallow soil samples (0 to 10 feet bgs) (Figures 5-5 through 5-8) showed the following.

PARTIALLY SCANNED OVERSIZE ITEM(S)

See document # 2249415
for partially scanned image(s).

FIGURE 5-5

For complete hardcopy version of the oversize document
contact the Region IX Superfund Records Center

UNIT 1 PHASE II	16B103				16B105		
	0'-1.0'	2.5'-5.0'	5'-7.0'	7.5'-10'	0'-1.0'	2.5'-5.0'	7.5'-10'
BENZ(A)ANTHRACENE	~	-	12	-	-	-	-
BENZO(A)PYRENE	15	-	6	-	-	-	-
BENZO(B)FLUORANTHENE	13	-	-	-	-	-	-
BENZO(K)FLUORANTHENE	3.8	-	-	-	-	-	-
CHRYSENE	22	-	17	-	-	-	-
DIBENZ(A,H)ANTHRACENE	28	-	-	-	-	-	-
INDENO(1,2,3-CD)PYRENE	74	-	25	-	-	-	-
TOTAL PAHs BY IA	>275	>275	-	>275	<60	<60	<60

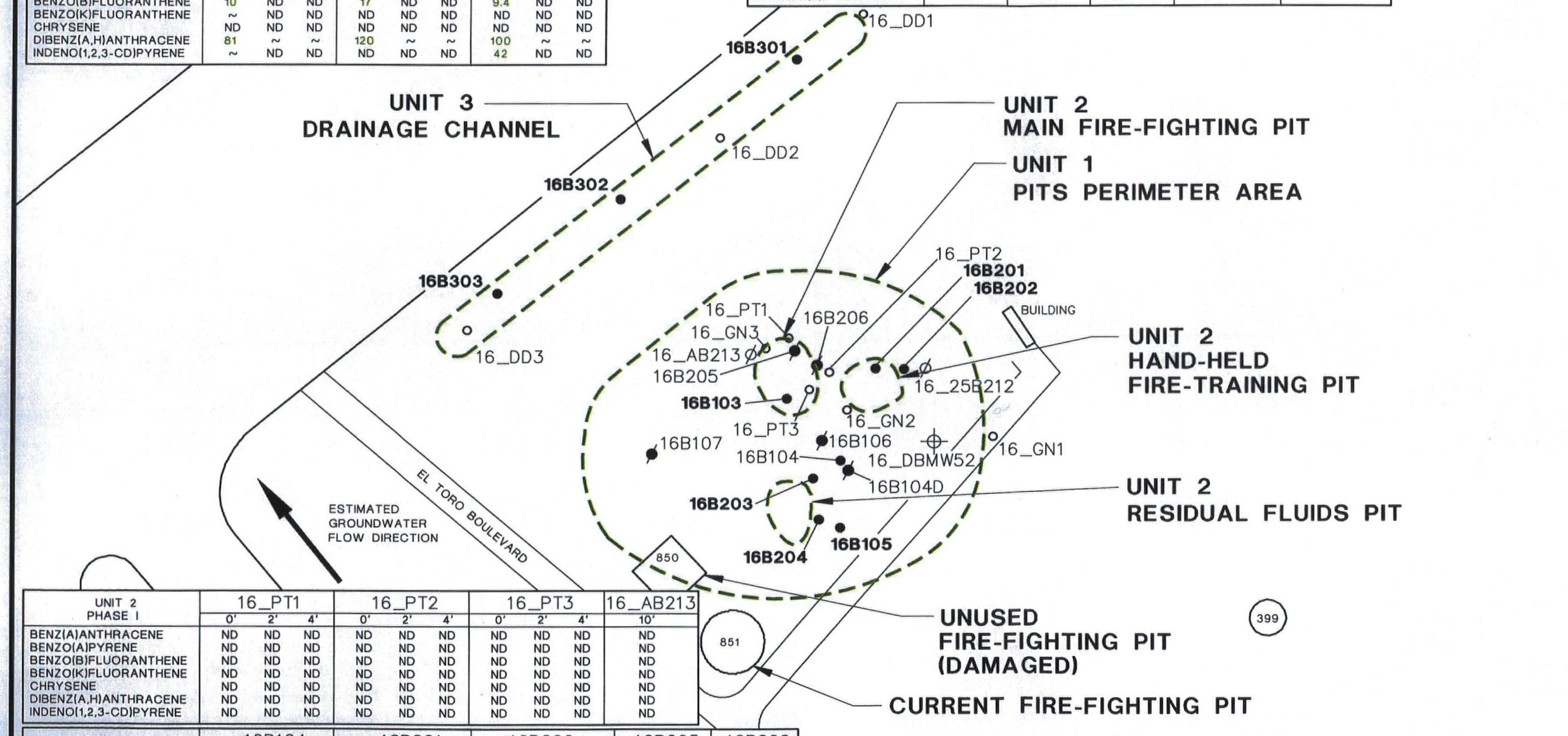
UNIT 1 PHASE II	16B106		16B107		16B203		
	0'-1.0'	5.5'-7.0'	0'-1.0'	5'-7.0'	0'-1.0'	2.5'-5'	7.5'-10'
BENZ(A)ANTHRACENE	ND	-	ND	ND	ND	-	-
BENZO(A)PYRENE	ND	-	ND	ND	ND	-	-
BENZO(B)FLUORANTHENE	ND	-	ND	ND	4.8	-	-
BENZO(K)FLUORANTHENE	ND	-	ND	ND	4.9	-	-
CHRYSENE	ND	-	ND	ND	ND	-	-
DIBENZ(A,H)ANTHRACENE	ND	-	ND	ND	~	-	-
INDENO(1,2,3-CD)PYRENE	11	-	ND	ND	8.1	-	-
TOTAL PAHs BY IA	>60,<275	<60	<60	<60	>60,<275	<60	<60

UNIT 1 PHASE II	16B204			
	0'-1.0'	2.5'-5.0'	5'-7.0'	7.5'-10'
BENZ(A)ANTHRACENE	ND	-	ND	-
BENZO(A)PYRENE	ND	-	ND	-
BENZO(B)FLUORANTHENE	ND	-	ND	-
BENZO(K)FLUORANTHENE	ND	-	ND	-
CHRYSENE	ND	-	ND	-
DIBENZ(A,H)ANTHRACENE	~	-	~	-
INDENO(1,2,3-CD)PYRENE	ND	-	ND	-
TOTAL PAHs BY IA	<60	<60	-	<60

UNIT 3 PHASE I	16_DD1		16_DD2			16_DD3		
	0'	2'	0'	2'	4'	0'	2'	4'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 1 PHASE I	16_GN1	16_GN2	16_GN3		16_25B212		16_DBMW52	
	0'	0'	0'	2'	5'	10'	5'	10'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 3 PHASE II	16B301			16B302			16B303		
	0'-1.0'	3.5'-5'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(A)PYRENE	11	ND	ND	18	ND	ND	12	ND	ND
BENZO(B)FLUORANTHENE	10	ND	ND	17	ND	ND	9.4	ND	ND
BENZO(K)FLUORANTHENE	~	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	81	~	~	120	~	~	100	~	~
INDENO(1,2,3-CD)PYRENE	~	ND	ND	ND	ND	ND	42	ND	ND



UNIT 2 PHASE I	16_PT1			16_PT2			16_PT3			16_AB213
	0'	2'	4'	0'	2'	4'	0'	2'	4'	10'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 2 PHASE II	16B104			16B201			16B202		
	0'-1.0'	2.5'-5.0'	7.5'-10'	0'-1.0'	3'-5.0'	7.5'-10'	0'-1.0'	2.5'-5'	7.5'-10'
BENZ(A)ANTHRACENE	-	-	-	~	-	-	-	-	-
BENZO(A)PYRENE	-	-	-	~	-	-	-	-	-
BENZO(B)FLUORANTHENE	-	-	-	~	-	-	-	-	-
BENZO(K)FLUORANTHENE	-	-	-	~	-	-	-	-	-
CHRYSENE	-	~	-	~	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	-	-	-	13	-	-	-	-	-
INDENO(1,2,3-CD)PYRENE	-	-	-	45	-	-	-	-	-
TOTAL PAHs BY IA	<60	>60,<275	>275	>60,<275	<60	<60	>60,<275	<60	<60

UNIT 2 PHASE II	16B205		16B206	
	0'-1.0'	5.5'-7.0'	0'-1.0'	5'-7'
BENZ(A)ANTHRACENE	ND	-	8.3	23
BENZO(A)PYRENE	8.8	-	26	10
BENZO(B)FLUORANTHENE	8.9	-	21	6.3
BENZO(K)FLUORANTHENE	ND	-	12	5.6
CHRYSENE	ND	-	7.3	22
DIBENZ(A,H)ANTHRACENE	11	-	21	ND
INDENO(1,2,3-CD)PYRENE	28	-	84	ND
TOTAL PAHs BY IA	>275	>275	>275	>275

LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

- PHASE I MONITORING WELL
- PHASE I DEEP OR ANGLE BORING
- PHASE I SURFACE AND NEAR-SURFACE SOIL SAMPLE
- PHASE II DEEP BORING
- PHASE II SURFACE AND NEAR SURFACE SOIL SAMPLE

UNIT 3 PHASE II	16B301		
	0'-1.0'	3.5'-5'	8.5'-10'
BENZO(A)PYRENE	11	ND	ND

SAMPLE LOCATION
DEPTH (IN FEET) SAMPLE TAKEN
ANALYTE
CONCENTRATION
COLOR NUMBER INDICATES DETECTION

NOTES:

ALL VALUES ARE IN MICROGRAMS PER KILOGRAM (µg/kg)

REPORTED TOTAL PAH RESULTS BY IMMUNOASSAY ANALYSIS ARE CALIBRATED TO PHENANTHRENE STANDARD

PAH = POLYNUCLEAR AROMATIC HYDROCARBON
IA = IMMUNOASSAY ANALYSIS
ND = NOT DETECTED
\- = NOT ANALYZED
~ = DATA DETERMINED UNUSABLE BY VALIDATION CONTRACTOR

NORTH
TRUE
\- N -

0 100 200
FEET

Record of Decision
Figure 5-6
Carcinogenic PAHs in Shallow Soil
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

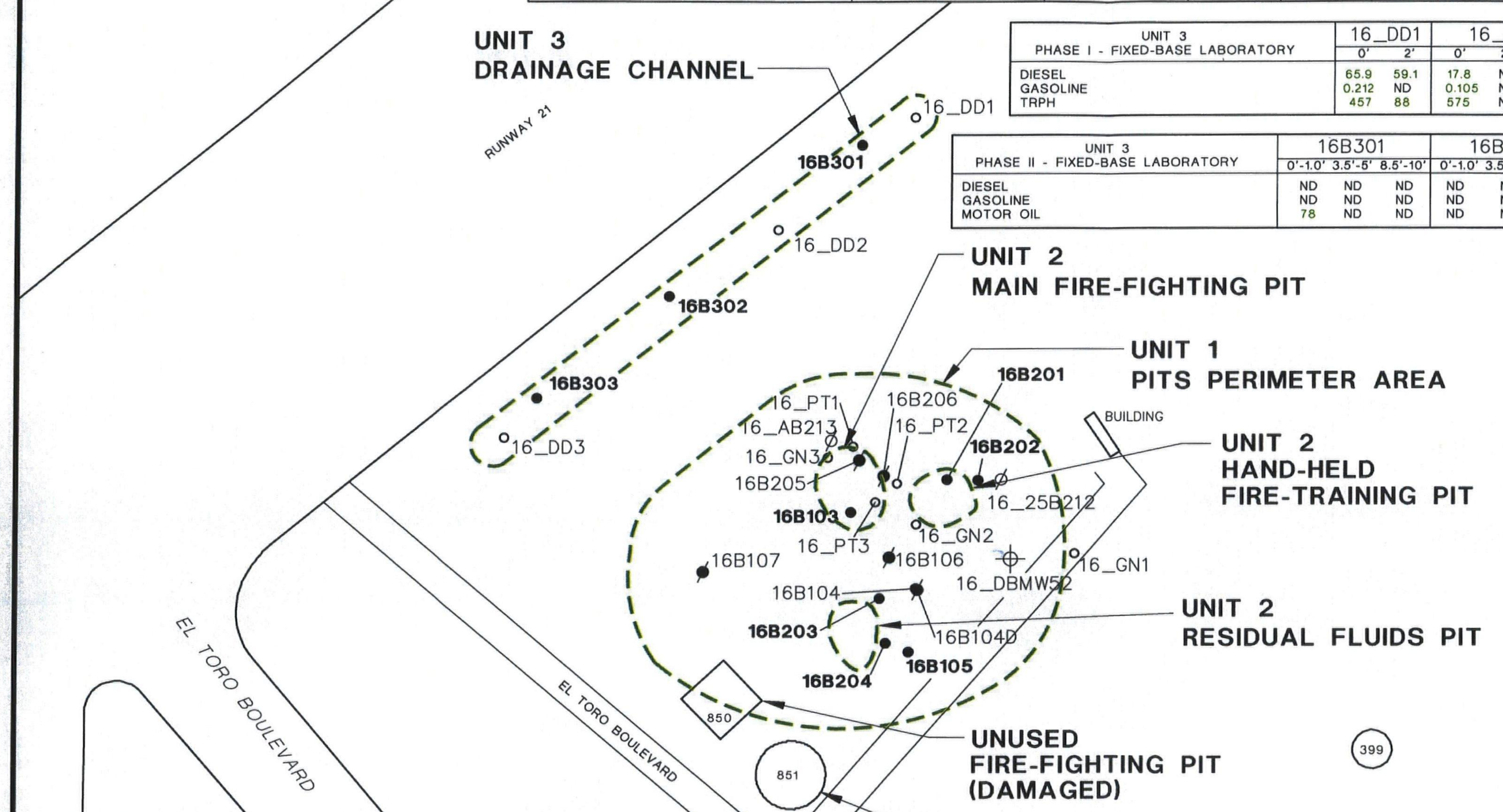
Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/14/02
File No: 045A9863
Job No: 23818-045
Rev No: B

UNIT 1 PHASE II - FIXED-BASE LABORATORY	16B103				16B105			16B106		16B107		16B203			16B204			
	0'-1.0'	2.5'-5'	5'-7.0'	7.5'-10'	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	5.5'-7'	0'-1.0'	5.5'-7'	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	2.5'-5'	5'-7.0'	7.5'-10'
DIESEL	-	2100	300	-	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	ND	-
GASOLINE	-	ND	ND	-	-	ND	-	0.075	-	ND	ND	-	ND	-	-	-	ND	-
MOTOR OIL	-	ND	120	-	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	ND	-
PHASE II - ON-SITE MOBILE LABORATORY																		
DIESEL	3100	2100	6300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND
GASOLINE	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND

UNIT 3 PHASE I - FIXED-BASE LABORATORY	16_DD1		16_DD2			16_DD3		
	0'	2'	0'	2'	4'	0'	2'	4'
DIESEL	65.9	59.1	17.8	ND	ND	29.9	ND	ND
GASOLINE	0.212	ND	0.105	ND	ND	0.152	ND	ND
TRPH	457	88	575	ND	ND	283	76	ND

UNIT 3 PHASE II - FIXED-BASE LABORATORY	16B301			16B302			16B303		
	0'-1.0'	3.5'-5'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'
DIESEL	ND	ND	ND	ND	ND	ND	ND	ND	ND
GASOLINE	ND	ND	ND	ND	ND	ND	ND	ND	ND
MOTOR OIL	78	ND	ND	ND	ND	ND	320	ND	ND



UNIT 2 PHASE I - FIXED-BASE LABORATORY	16_PT1			16_PT2			16_PT3			16_AB213
	0'	2'	4'	0'	2'	4'	0'	2'	4'	10'
DIESEL	12100	17500	38100	838	57700	68800	917	55400	75200	20600
GASOLINE	166	168	299	178	2690	2230	14.9	2420	3120	5540
TRPH	8404	6956	17190	7636	28859	18933	2844	23766	39101	3986

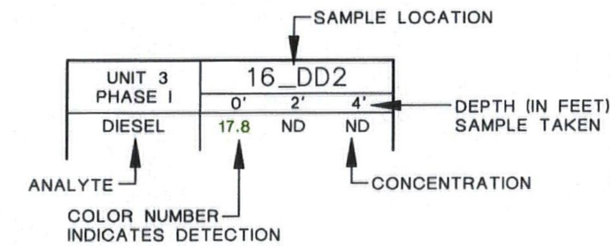
UNIT 2 PHASE II - FIXED-BASE LABORATORY	16B104			16B201			16B202			16B205		16B206	
	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	3'-5.0'	7.5'-10'	0'-1.0'	2,5'-5'	7.5'-10'	0'-1.0'	5.5'-7'	0'-1.0'	5'-7.0'
DIESEL	-	-	16000	200	-	-	-	-	ND	34	-	2400	14000
GASOLINE	-	-	ND	ND	-	-	-	-	ND	ND	-	~	ND
MOTOR OIL	-	-	ND	340	-	-	-	-	ND	20	-	ND	ND
PHASE II - ON-SITE MOBILE LABORATORY													
DIESEL	ND	1600	20000	12	ND	ND	ND	ND	ND	ND	15000	700	20000
GASOLINE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

LEGEND

- 10 — BUILDING OR PAD
- IMPROVED ROAD OR RUNWAY
- UNIT BOUNDARY

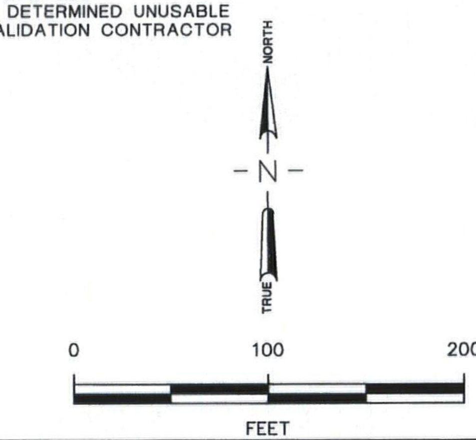
APPROXIMATE SAMPLING LOCATIONS

- PHASE I MONITORING WELL
- PHASE I DEEP OR ANGLE BORING
- PHASE I SURFACE AND NEAR-SURFACE SOIL SAMPLE
- PHASE II DEEP BORING
- PHASE II SURFACE AND NEAR-SURFACE SOIL SAMPLE



NOTES:
ALL VALUES ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)
MOTOR OIL RESULTS COMPARABLE TO PHASE I TRPH DATA

TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
ND = NOT DETECTED
- = NOT ANALYZED
~ = DATA DETERMINED UNUSABLE BY VALIDATION CONTRACTOR



Record of Decision
Figure 5-7
Petroleum Hydrocarbons in Shallow Soil Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

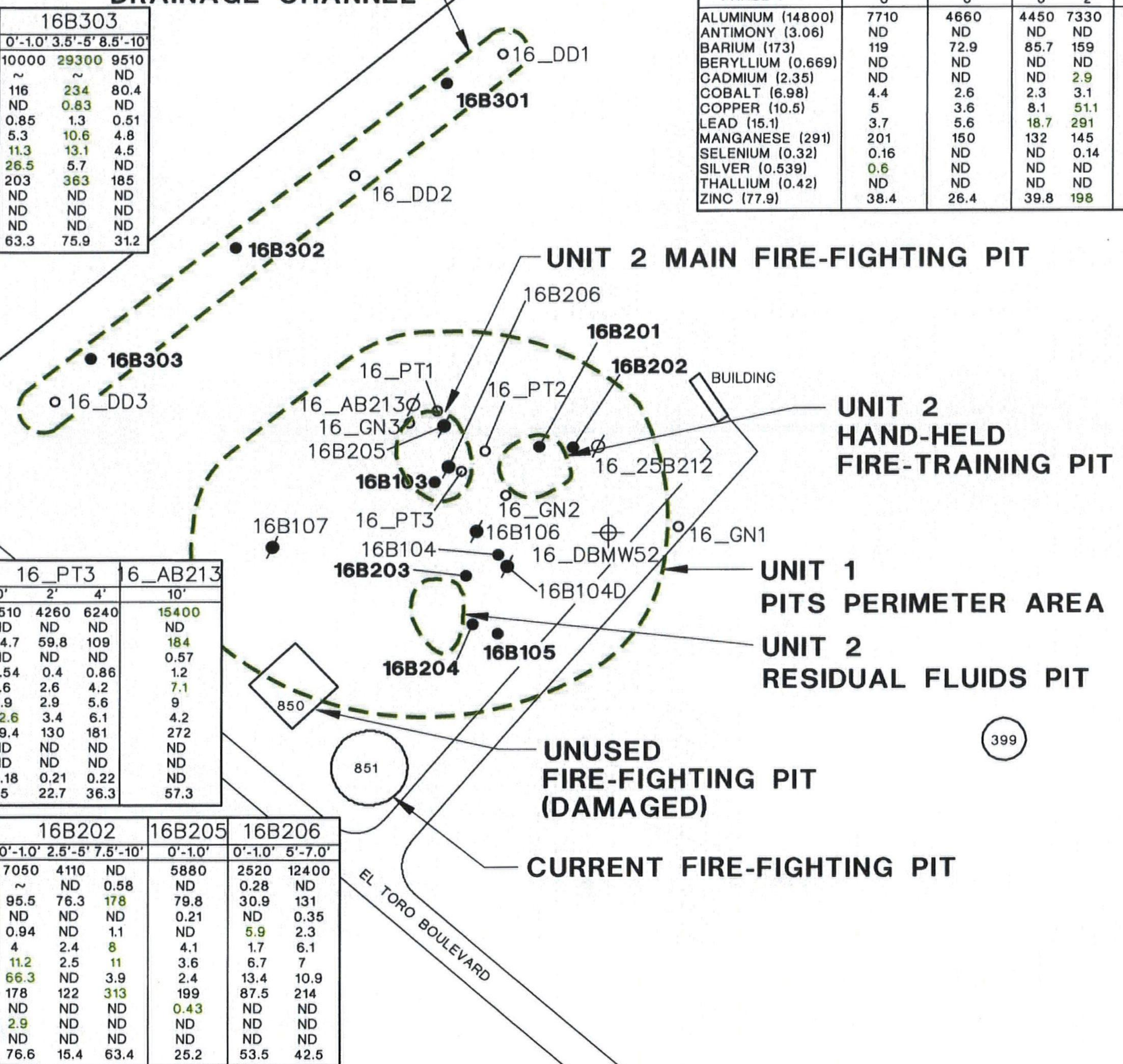
Date: 11/14/02
File No: 045A9864
Job No: 23818-045
Rev No: C

UNIT 3 PHASE I	16_DD1		16_DD2			16_DD3		
	0'	2'	0'	2'	4'	0'	2'	4'
ALUMINUM (14800)	6610	12400	4680	15400	4250	8240	22500	13500
ANTIMONY (3.06)	ND	ND	ND	ND	ND	ND	ND	3.3
BARIUM (173)	82.3	142	68.6	191	81.5	75.3	185	186
BERYLLIUM (0.669)	ND	ND	ND	ND	ND	ND	0.97	ND
CADMIUM (2.35)	ND	ND	ND	1.5	ND	0.96	1.7	1.3
COBALT (6.98)	4.1	4.8	4.2	8.2	2.8	4.3	9.8	6.4
COPPER (10.5)	7.9	8.2	6.5	12	3.4	10.2	13.6	9.7
LEAD (15.1)	15.8	3.6	15.7	5.4	1.3	27.2	3.6	2.5
MANGANESE (291)	187	230	161	349	144	205	365	271
SELENIUM (0.32)	ND	ND	ND	0.15	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	0.38	ND	ND	0.38	0.29
ZINC (77.9)	45.6	46.4	36	69.3	24.2	61.9	74.7	49.2

UNIT 3 PHASE II	16B301			16B302			16B303		
	0'-1.0'	3'-5.0'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'	0'-1.0'	3.5'-5'	8.5'-10'
ALUMINUM (14800)	5890	25300	10800	9230	21800	14200	10000	29300	9510
ANTIMONY (3.06)	~	~	~	~	~	ND	~	~	ND
BARIUM (173)	103	199	112	89.6	197	140	116	234	80.4
BERYLLIUM (0.669)	ND	0.75	ND	ND	0.84	ND	ND	0.83	ND
CADMIUM (2.35)	1.5	1.3	0.56	0.93	1	0.73	0.85	1.3	0.51
COBALT (6.98)	4.6	9.7	4.8	5.2	9.1	7.4	5.3	10.6	4.8
COPPER (10.5)	20.1	12.7	5.8	14.2	12.2	8.2	11.3	13.1	4.5
LEAD (15.1)	33	5.3	ND	53.8	5.2	3.3	26.5	5.7	ND
MANGANESE (291)	260	338	194	229	327	268	203	363	185
SELENIUM (0.32)	0.74	ND	ND	0.66	ND	0.44	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC (77.9)	98.7	70.1	33.7	78.6	68.6	53.1	63.3	75.9	31.2

UNIT 1 PHASE II	16B103				16B105			16B106	16B107		16B203			16B204			
	0'-1.0'	2.5'-5'	5'-7.0'	7.5'-10'	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	0'-1.0'	5'-7.0'	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	2.5'-5'	5'-7.0'	7.5'-10'
ALUMINUM (14800)	4070	3880	13600	11000	2620	3550	10600	12600	7510	10800	6420	3150	14500	4600	2940	2640	6880
ANTIMONY (3.06)	~	~	~	~	~	~	~	~	~	~	~	~	ND	ND	~	~	~
BARIUM (173)	45.3	42.5	135	134	34.3	52.7	127	143	96.4	121	86.2	61.2	149	104	50.9	30.2	94.7
BERYLLIUM (0.669)	ND	ND	ND	ND	ND	ND	0.24	0.35	ND	0.45	ND	ND	ND	ND	ND	0.14	ND
CADMIUM (2.35)	0.43	0.49	1	0.55	0.15	0.16	0.39	ND	ND	ND	0.83	ND	0.87	3.1	ND	0.2	0.62
COBALT (6.98)	2.5	2.2	7	6	1.7	2.2	5.5	6.8	4	6.5	3.4	2.4	6.8	2.9	1.9	1.5	4.4
COPPER (10.5)	3.3	2.8	8.8	7.9	1.5	1.9	5.9	7.1	8.8	6.7	10.6	2	8.8	11.3	ND	1.6	5
LEAD (15.1)	22.1	1.3	3.9	3.3	0.8	0.98	2.3	3.2	9.8	2.6	16.5	ND	3.3	8.5	ND	1.1	ND
MANGANESE (291)	105	104	232	214	80	102	216	264	170	248	142	98.3	269	138	104	77.9	182
SELENIUM (0.32)	0.43	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	0.62	ND	ND	ND	0.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC (77.9)	24.6	15.2	51.4	42.3	10.9	14.6	36.8	48.6	43.3	44.3	59.4	14.6	51	46.9	15.4	10.4	30

UNIT 1 PHASE I	16_GN1	16_GN2	16_GN3		16_25B212		16_DBMW52	
	0'	0'	0'	2'	5'	10'	5'	10'
ALUMINUM (14800)	7710	4660	4450	7330	10500	4390	9630	23900
ANTIMONY (3.06)	ND	ND	ND	ND	ND	ND	ND	ND
BARIUM (173)	119	72.9	85.7	159	153	110	136	289
BERYLLIUM (0.669)	ND	ND	ND	ND	0.61	ND	0.33	0.7
CADMIUM (2.35)	ND	ND	ND	2.9	0.77	0.44	0.85	1.4
COBALT (6.98)	4.4	2.6	2.3	3.1	6.3	2.8	4.4	8.9
COPPER (10.5)	5	3.6	8.1	51.1	8.8	ND	8.4	13.1
LEAD (15.1)	3.7	5.6	18.7	291	2.8	0.98	1.8	2.1
MANGANESE (291)	201	150	132	145	259	156	266	382
SELENIUM (0.32)	0.16	ND	ND	0.14	ND	ND	ND	ND
SILVER (0.539)	0.6	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	ND	0.27	0.17	0.26	0.37
ZINC (77.9)	38.4	26.4	39.8	198	47.1	24.4	43.9	83.5



UNIT 2 PHASE I	16_PT1			16_PT2			16_PT3			16_AB213
	0'	2'	4'	0'	2'	4'	0'	2'	4'	10'
ALUMINUM (14800)	6100	5030	20800	6350	4470	10200	2510	4260	6240	15400
ANTIMONY (3.06)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BARIUM (173)	86.4	78.9	243	94	72.9	142	54.7	59.8	109	184
BERYLLIUM (0.669)	ND	ND	1.1	ND	ND	ND	ND	ND	ND	0.57
CADMIUM (2.35)	0.92	0.46	1.5	0.9	0.49	0.99	0.54	0.4	0.86	1.2
COBALT (6.98)	3.1	2.5	10.2	3.2	2.9	5.6	1.6	2.6	4.2	7.1
COPPER (10.5)	10	3.9	12.7	9.1	4.5	8.6	5.9	2.9	5.6	9
LEAD (15.1)	19.5	1.5	4.5	25.3	7	4.6	22.6	3.4	6.1	4.2
MANGANESE (291)	158	146	426	168	137	249	79.4	130	181	272
SELENIUM (0.32)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	0.18	0.15	0.64	ND	ND	ND	0.18	0.21	0.22	ND
ZINC (77.9)	53.2	23.1	80	54.3	28.6	47.6	35	22.7	36.3	57.3

UNIT 2 PHASE II	16B104			16B201			16B202			16B205	16B206	
	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	3'-5.0'	7.5'-10'	0'-1.0'	2.5'-5'	7.5'-10'	0'-1.0'	0'-1.0'	5'-7.0'
ALUMINUM (14800)	7330	8510	9060	6100	2260	9660	7050	4110	ND	5880	2520	12400
ANTIMONY (3.06)	~	~	~	~	~	~	~	ND	0.58	ND	0.28	ND
BARIUM (173)	86.5	119	110	87.9	56.3	132	95.5	76.3	178	79.8	30.9	131
BERYLLIUM (0.669)	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.21	ND	0.35
CADMIUM (2.35)	0.36	0.57	0.37	0.69	0.2	0.76	0.94	ND	1.1	ND	5.9	2.3
COBALT (6.98)	4.1	5.5	4.8	3.6	1.5	5.5	4	2.4	8	4.1	1.7	6.1
COPPER (10.5)	4.8	8.4	5.5	9.3	1.7	6.1	11.2	2.5	11	3.6	6.7	7
LEAD (15.1)	5.6	14.9	2.2	39.8	0.65	2.7	66.3	ND	3.9	2.4	13.4	10.9
MANGANESE (291)	170	155	155	146	93.7	225	178	122	313	199	87.5	214
SELENIUM (0.32)	ND	0.57	ND	0.42	ND	ND	ND	ND	ND	0.43	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	2.9	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	0.73	ND	ND	ND	0.69	ND	ND	ND	ND	ND	ND
ZINC (77.9)	35	62.6	32.1	59.7	11	38.3	76.6	15.4	63.4	25.2	53.5	42.5

LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

PHASE I MONITORING WELL

PHASE I DEEP OR ANGLE BORING

PHASE I SURFACE AND NEAR-SURFACE SOIL SAMPLE

PHASE II DEEP BORING

PHASE II SURFACE AND NEAR-SURFACE SOIL SAMPLE

UNIT 1 PHASE I	16_DD2		
	0'	2'	4'
ALUMINUM (14800)	4680	15400	4250

SAMPLE LOCATION

DEPTH (IN FEET) SAMPLE TAKEN

ANALYTE

BACKGROUND CONCENTRATION

REPORTED CONCENTRATION

COLOR VALUES EXCEED THE RESPECTIVE BACKGROUND CONCENTRATIONS

NOTE:

ALL VALUES ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

COMMONLY OCCURRING METALS CONSIDERED ESSENTIAL NUTRIENTS (CALCIUM, IRON, MAGNESIUM, POTASSIUM, AND SODIUM) ARE NOT IDENTIFIED ON THIS FIGURE

ND = NOT DETECTED
- = NOT ANALYZED
~ = DATA DETERMINED UNUSABLE BY VALIDATION CONTRACTOR

NORTH
N
TRUE

0 1-INCH 2-INCH
FEET

Record of Decision
Figure 5-8
Total Metals Above Background in Shallow Soil
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/14/02
File No: 045A9865
Job No: 23818-045
Rev No: C

- Nine VOCs were reported in 16 shallow soil samples at concentrations from less than 10 micrograms per kilogram (µg/kg) to greater than 10,000 µg/kg.
- Eight SVOCs were reported in ten shallow soil samples from Units 1 and 2 at concentrations from 160 µg/kg to greater than 10,000 µg/kg.
- Trace (low milligrams per kilogram [mg/kg]) to high (greater than 10,000 mg/kg) concentrations of diesel, gasoline, and/or TRPH were reported in 20 shallow soil samples collected at locations sitewide.
- Twelve of the 23 target analyte list (TAL) metals were reported at concentrations above their respective background values in shallow soil samples at Site 16.

Analytical results for deeper subsurface soil samples (greater than 10 feet bgs) (Figures 5-9 through 5-12) showed the following.

- One VOC (acetone) was reported in one sample from boring 16_25B212 at a concentration of 22 µg/kg (also in field blank at the same magnitude). A maximum of six VOCs were reported in five deeper subsurface soil samples from angle boring 16_AB213 at concentrations from 580 µg/kg to greater than 10,000 µg/kg.
- One SVOC (naphthalene) was reported in two deeper subsurface soil samples from angle boring 16_AB213 at concentrations greater than 6,000 µg/kg.
- Trace to high concentrations of diesel, gasoline, and/or TRPH were reported in five deeper subsurface soil samples from angle boring 16_AB213 and in one soil sample from each of the three Site 16 monitoring wells.
- Sixteen of the 23 TAL metals were reported at concentrations above their respective Former MCAS El Toro background values in deeper subsurface soil samples at Site 16.

Analytical results for groundwater samples collected from the three Site 16 wells showed the following.

- Trace (low micrograms per liter [µg/L]) concentrations of two VOCs (chloroform and methylene chloride) were reported in a December 1992 sample and a trace concentration of one VOC (TCE) was reported in a July 1993 sample from off-site upgradient well 16_UGMW33.
- Up to 9 of the 23 TAL metals were reported in samples from the three wells during both rounds of groundwater monitoring.

5.2.3.2 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AERIAL PHOTOGRAPH SURVEY

Results of a U.S. EPA aerial photograph survey performed for Former MCAS El Toro indicate that features related to historical activities conducted at Site 16 are first visible on a 1980 photograph (Figure 5-13). An area of approximately 250 by 400 feet of disturbed earth and a circular impoundment near the center of the site are visible. In a 1991 photograph, these features are still present; however, the area has been partly revegetated (JEG 1993c).

5.2.3.3 SCIENCE APPLICATIONS INTERNATIONAL CORPORATION AERIAL PHOTOGRAPH SURVEY

The aerial photographic survey performed by Science Applications International Corporation identified a circular impoundment possibly containing liquid (the main firefighting pit) in the area of Site 16 on a 1974 photograph. A rectangular impoundment (the residual fluids pit) is visible in a 1984 aerial photograph (SAIC 1993).

5.2.3.4 EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at Former MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facilities Management Department (later known as the Installations Department) with knowledge of Station operations and procedures for storage/disposal of hazardous materials and waste. Interviewers included federal and state regulatory agency personnel, DON and Station personnel, and contractor personnel. During these interviews, the following information pertaining to Site 16 was obtained (JEG 1994c).

- The panel recalled that a crash crew station was located in this general area.
- The crash crew station was located near the center of the airfield and provided subsurface shelter to the crash crew in case of an emergency.

During planning for the Phase II RI, Mr. Vish Parpiani of the Former MCAS El Toro Environmental Department indicated that fuels and other flammable liquids burned in the crash crew training pits were transported to Site 16 in tanker trucks just before each training exercise. For safety reasons, these liquids were not stored on-site.

5.2.3.5 PHASE II REMEDIAL INVESTIGATION

Sampling was conducted during the Phase II RI to fill data gaps from previous investigations and collect data necessary to conduct the HHRA (BNI 1997). The following activities were conducted.

- Shallow soil (0 to 10 feet bgs) samples were collected at 15 Phase II locations throughout Units 1, 2, and 3.
- Deeper subsurface soil (10 to 197 feet bgs) samples were collected at five locations within Units 1 and 2.

Deeper subsurface samples were collected whenever field screening or laboratory analytical results suggested that analytes with reported concentrations exceeding their respective preliminary remediation goals (PRGs) or background values were present at depths greater than 10 feet bgs. Soil samples were analyzed in the field using immunoassay field kits to screen for polynuclear aromatic hydrocarbon (PAH) compounds. Soil samples were also analyzed in the field using an on-site mobile

PARTIALLY SCANNED
OVERSIZE ITEM(S)

See document # 2249415

for partially scanned image(s).

FIGURE 5-9

For complete hardcopy version of the oversize document contact the Region IX Superfund Records Center

UNIT 1 PHASE II	16B107																			
	11'-13'	20'-22'	25'-27'	30'-32'	40'-42'	50'-52'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	180'-182'	190'-192'
BENZ(A)ANTHRACENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
BENZO(A)PYRENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
BENZO(B)FLUORANTHENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
BENZO(K)FLUORANTHENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
CHRYSENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
DIBENZ(A,H)ANTHRACENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
INDENO(1,2,3-CD)PYRENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
TOTAL PAHs by IA	<60	<60	-	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60

UNIT 2 PHASE II	16B104D																	
	20'-22'	25'-27'	30'-32'	40'-42'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	131'-133'	140'-142'	150'-152'	160'-162'	170'-172'	175'-177'	180'-182'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	-	ND	-	ND	-	ND	ND	ND	-	-	ND	ND	ND
TOTAL PAHs by IA	>275	-	>60,<275	<60	<60	<60	<60	<60	<60	<60	<60	-	<60	<60	<60	<60	-	<60

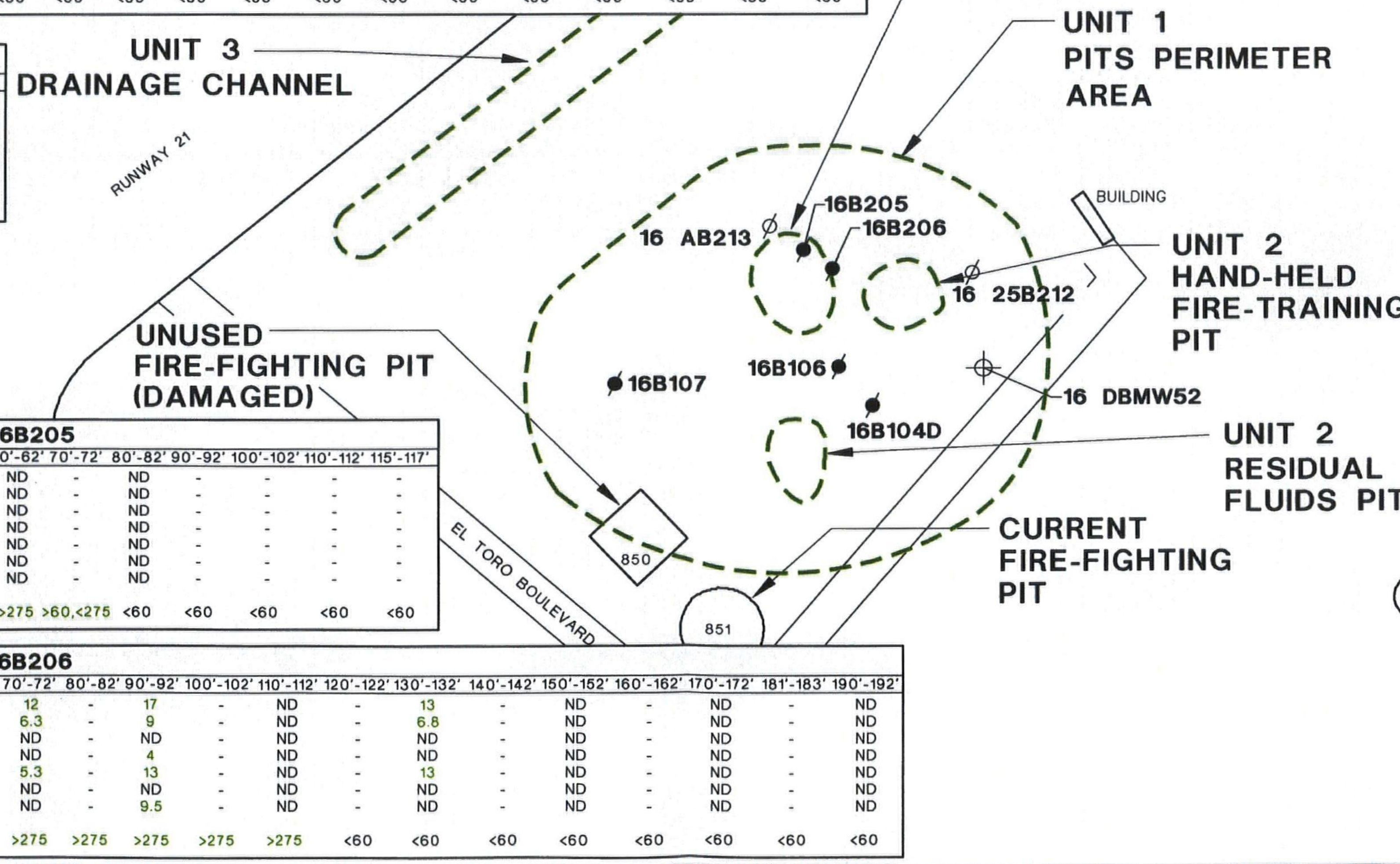
UNIT 1 PHASE II	16B106																		
	10'-12'	20'-22'	25'-27'	30'-32'	40'-42'	50'-52'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	180'-182'
BENZ(A)ANTHRACENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
BENZO(A)PYRENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
BENZO(B)FLUORANTHENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
BENZO(K)FLUORANTHENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
CHRYSENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
DIBENZ(A,H)ANTHRACENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
INDENO(1,2,3-CD)PYRENE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
TOTAL PAHs by IA	<60	<60	-	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60	<60

UNIT 1 PHASE I	16 25B212			16 DBMW52					
	15'	20'	25'	13'	18'	23'	33'	53'	188'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 2 PHASE I	16 AB213				
	20'	30'	40'	50'	60'
BENZ(A)ANTHRACENE	ND	ND	ND	ND	ND
BENZO(A)PYRENE	ND	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	ND	ND	ND	ND	ND
BENZO(K)FLUORANTHENE	ND	ND	ND	ND	ND
CHRYSENE	ND	ND	ND	ND	ND
DIBENZ(A,H)ANTHRACENE	ND	ND	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	ND	ND	ND	ND	ND

UNIT 2 PHASE II	16B205												
	10'-12'	20'-22'	30'-32'	40'-42'	51'-53'	55'-57'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	115'-117'
BENZ(A)ANTHRACENE	-	ND	-	ND	-	4.2	ND	-	ND	-	-	-	-
BENZO(A)PYRENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
BENZO(B)FLUORANTHENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
BENZO(K)FLUORANTHENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
CHRYSENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
DIBENZ(A,H)ANTHRACENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
INDENO(1,2,3-CD)PYRENE	-	ND	-	ND	-	ND	ND	-	ND	-	-	-	-
TOTAL PAHs by IA	>275	>275	>275	>275	>275	-	>275	>60,<275	<60	<60	<60	<60	<60

UNIT 2 PHASE II	16B206																		
	10'-12'	20'-22'	30'-32'	40'-42'	50'-52'	61'-63.5'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	181'-183'	190'-192'
BENZ(A)ANTHRACENE	18	-	18	-	8.7	-	12	-	17	-	ND	-	13	-	ND	-	ND	-	ND
BENZO(A)PYRENE	12	-	10	-	7.7	-	6.3	-	9	-	ND	-	6.8	-	ND	-	ND	-	ND
BENZO(B)FLUORANTHENE	5.8	-	4.3	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
BENZO(K)FLUORANTHENE	6.4	-	4.2	-	ND	-	ND	-	4	-	ND	-	ND	-	ND	-	ND	-	ND
CHRYSENE	19	-	16	-	12	-	5.3	-	13	-	ND	-	13	-	ND	-	ND	-	ND
DIBENZ(A,H)ANTHRACENE	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
INDENO(1,2,3-CD)PYRENE	21	-	14	-	ND	-	ND	-	9.5	-	ND	-	ND	-	ND	-	ND	-	ND
TOTAL PAHs by IA	>275	>275	>275	>275	>275	>275	>275	>275	>275	>275	>275	<60	<60	<60	<60	<60	<60	<60	<60



LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

PHASE I MONITORING WELL

PHASE I DEEP OR ANGLE BORING

PHASE II DEEP BORING

SAMPLE LOCATION

UNIT 1 PHASE I	16B206	
	90'-92'	110'-112'
BENZ(A)ANTHRACENE	17	ND

DEPTH (IN FEET) SAMPLE TAKEN

ANALYTE

CONCENTRATION

COLOR NUMBER INDICATES DETECTION

NOTES:

ALL VALUES ARE IN MICROGRAMS PER KILOGRAM (µg/kg)

REPORTED TOTAL PAH RESULTS BY IMMUNOASSAY ANALYSIS ARE CALIBRATED TO PHENANTHRENE STANDARD

PAH = POLYNUCLEAR AROMATIC HYDROCARBON
IA = IMMUNOASSAY ANALYSIS
ND = NOT DETECTED
- = NOT ANALYZED

NORTH
N
TRUE

0 100 200
FEET

Record of Decision

Figure 5-10

Carcinogenic PAHs in Deeper Subsurface Soil Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

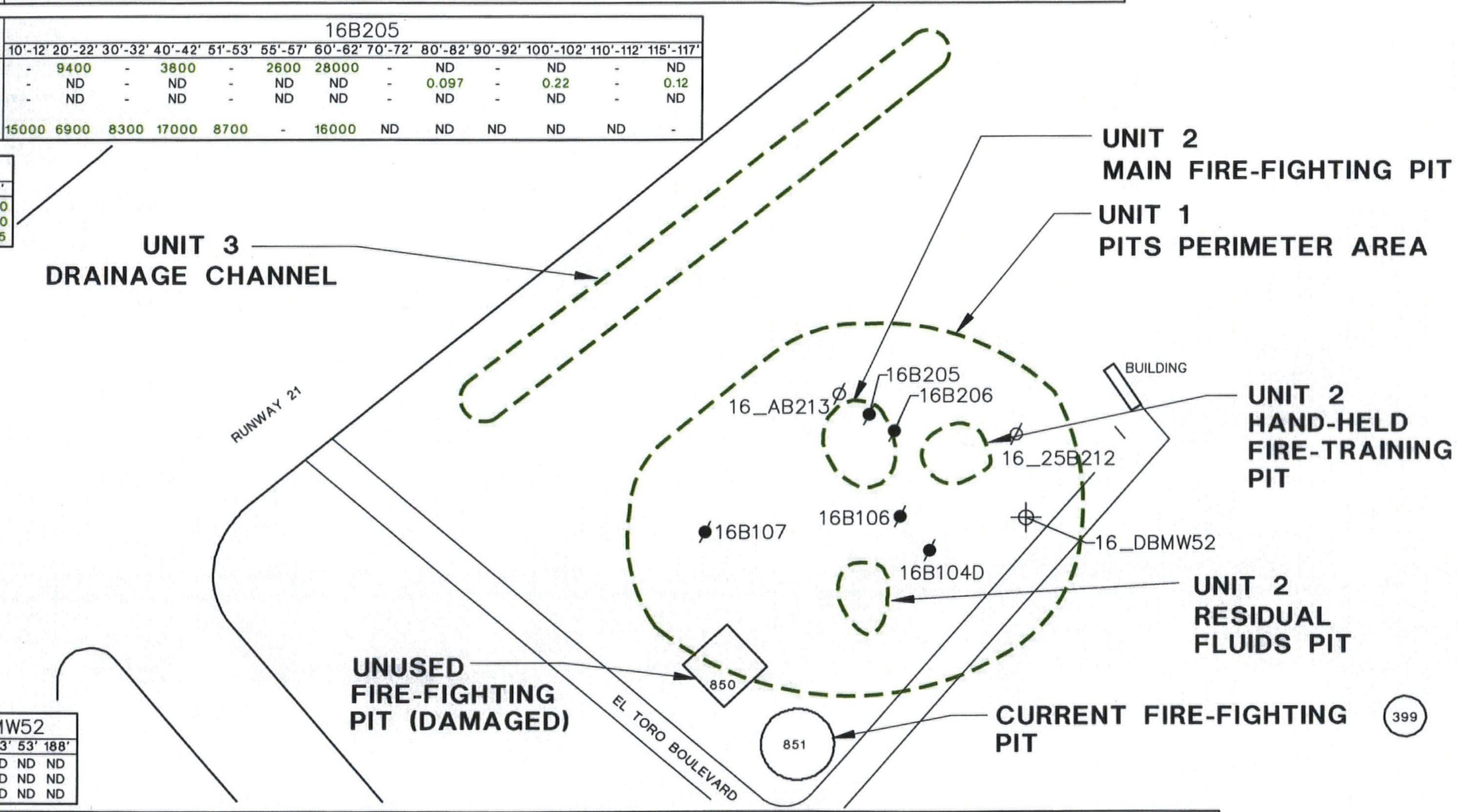
Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045A9866
Job No: 23818-045
Rev No: D

UNIT 2 PHASE II	16B206																		
	10'-12'	20'-22'	30'-32'	40'-42'	50'-52'	61'-63.5'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	181'-183'	190'-192'
DIESEL	4000	-	8600	-	8500	-	9400	-	7600	-	11	-	ND	-	ND	-	ND	-	ND
GASOLINE	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
MOTOR OIL	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
PHASE II - ON-SITE MOBILE LABORATORY DIESEL	15000	11000	8900	26000	17000	7600	17000	17000	11000	ND	3800	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 2 PHASE II	16B205												
	10'-12'	20'-22'	30'-32'	40'-42'	51'-53'	55'-57'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	115'-117'
DIESEL	-	9400	-	3800	-	2600	28000	-	ND	-	ND	-	ND
GASOLINE	-	ND	-	ND	-	ND	ND	-	0.097	-	0.22	-	0.12
MOTOR OIL	-	ND	-	ND	-	ND	ND	-	ND	-	ND	-	ND
PHASE II - ON-SITE MOBILE LABORATORY DIESEL	15000	6900	8300	17000	8700	-	16000	ND	ND	ND	ND	ND	-

UNIT 2 PHASE I	16_AB213				
	20'	30'	40'	50'	60'
DIESEL	23600	17700	14800	40000	7040
GASOLINE	7040	5620	5020	6440	4690
TRPH	5524	5428	2664	4731	2025



UNIT 1 PHASE I	16_25B212			16_DBMW52					
	15'	20'	25'	13'	18'	23'	33'	53'	188'
DIESEL	ND	ND	ND	ND	ND	ND	ND	ND	ND
GASOLINE	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRPH	ND	ND	29	814	ND	ND	ND	ND	ND

UNIT 2 PHASE II	16B104D																				
	15'-17'	20'-22'	25'-27'	30'-32'	40'-42'	56'-58'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	131'-133'	135'-137'	140'-142'	150'-152'	160'-162'	170'-172'	175'-177'	180'-182'
DIESEL	-	890	600	430	ND	-	ND	-	ND	-	ND	-	ND	ND	-	ND	-	-	ND	ND	ND
GASOLINE	-	ND	ND	ND	ND	-	ND	-	ND	-	ND	-	ND	ND	-	ND	-	-	ND	ND	ND
MOTOR OIL	-	ND	ND	ND	ND	-	ND	-	ND	-	ND	-	ND	ND	-	ND	-	-	ND	ND	ND
PHASE II - ON-SITE MOBILE LABORATORY DIESEL	12000	ND	-	11000	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	-	ND

UNIT 1 PHASE II	16B106																		
	10'-12'	20'-22'	25'-27'	30'-32'	40'-42'	50'-52'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	180'-182'
DIESEL	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
GASOLINE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	0.081
MOTOR OIL	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND
PHASE II - ON-SITE MOBILE LABORATORY DIESEL	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

UNIT 1 PHASE II	16B107																			
	11'-13'	20'-22'	25'-27'	30'-32'	40'-42'	50'-52'	60'-62'	70'-72'	80'-82'	90'-92'	100'-102'	110'-112'	120'-122'	130'-132'	140'-142'	150'-152'	160'-162'	170'-172'	180'-182'	190'-192'
DIESEL	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
GASOLINE	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
MOTOR OIL	-	ND	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-	ND	-
PHASE II - ON-SITE MOBILE LABORATORY DIESEL	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

PHASE I MONITORING WELL

PHASE I DEEP OR ANGLE BORING

PHASE II DEEP BORING

SAMPLE LOCATION

UNIT 1 PHASE I	16_25B212		
	15'	20'	25'
TRPH	ND	ND	29

DEPTH (IN FEET) SAMPLE TAKEN

ANALYTE

CONCENTRATION

COLOR NUMBER INDICATES DETECTION

NOTES:

ALL VALUES ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

MOTOR OIL RESULTS COMPARABLE TO PHASE I TRPH DATA

TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

ND = NOT DETECTED

- = NOT ANALYZED

~ = DATA DETERMINED UNUSABLE BY VALIDATION CONTRACTOR

NORTH

TRUE

N

0 100 200

FEET

Record of Decision

Figure 5-11

Petroleum Hydrocarbons in Deeper Subsurface Soil

Site 16 - Crash Crew Pit No. 2

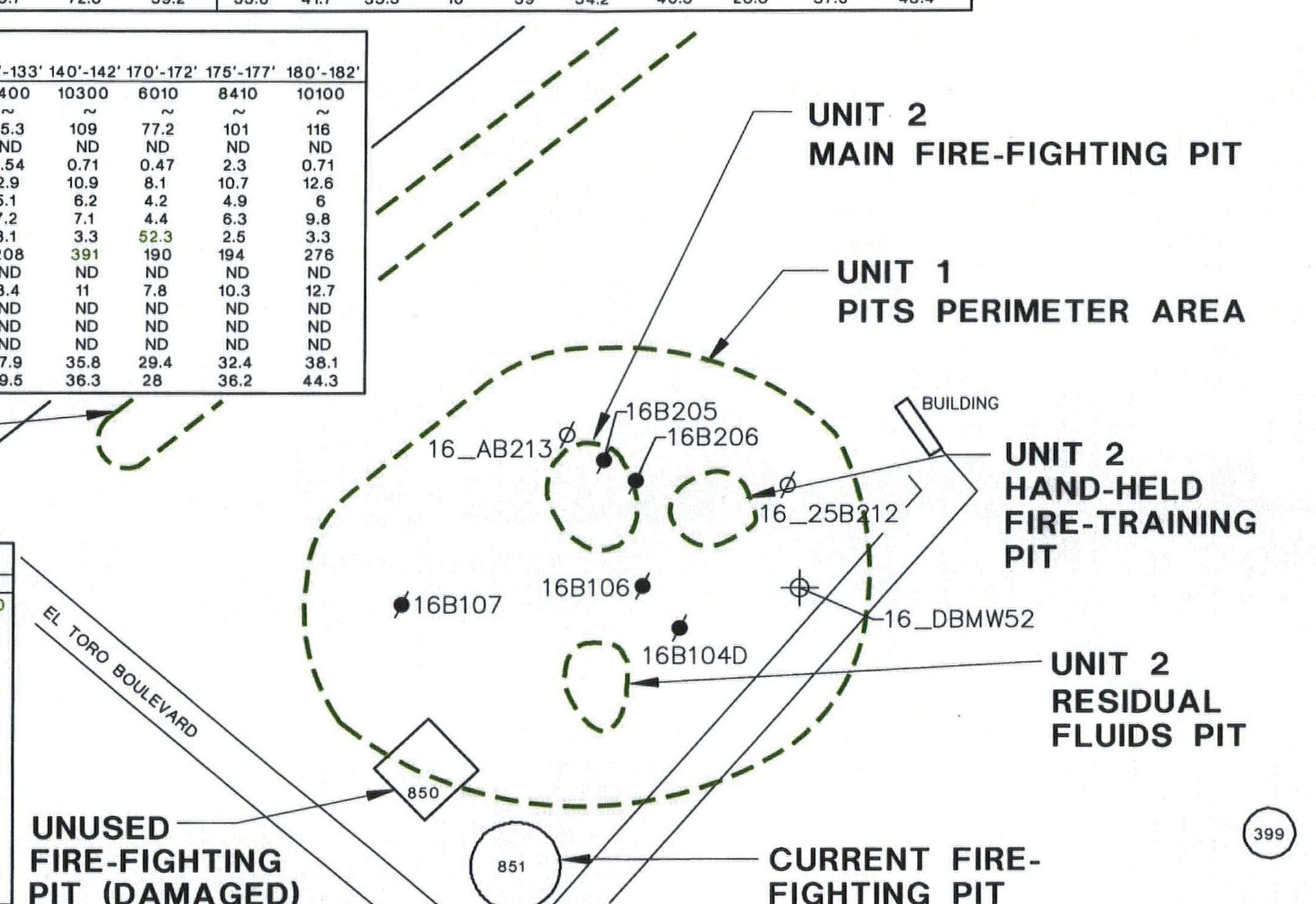
Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045A9867
Job No: 23818-045
Rev No: B

UNIT 1 PHASE II	16B106										16B107									
	20'-22'	25'-27'	40'-42'	60'-62'	80'-82'	100'-102'	120'-122'	140'-142'	160'-162'	180'-182'	20'-22'	25'-27'	40'-42'	60'-62'	80'-82'	100'-102'	120'-122'	140'-142'	160'-162'	180'-182'
ALUMINUM (14800)	13200	8390	8330	22800	16800	13400	10400	12400	22700	16500	12700	9900	8500	3070	12200	8480	10300	8080	8350	11500
ANTIMONY (3.06)	~	~	~	~	~	~	ND	~	~	~	~	~	~	~	~	~	~	~	~	~
BARIUM (173)	167	107	81.4	234	86.5	98.7	118	115	145	109	187	138	116	80.1	121	91.4	120	96.8	70.3	107
BERYLLIUM (0.669)	0.41	0.28	0.22	0.59	0.52	0.44	0.31	0.32	0.69	0.51	ND	ND	ND	ND	0.4	0.34	0.35	0.37	0.35	0.44
CADMIUM (2.35)	0.091	0.1	ND	0.58	0.19	0.65	1.2	1.2	1.5	2.6	0.3	0.51	0.28	0.51	0.43	0.13	0.6	0.11	0.27	4
CHROMIUM (26.9)	12.2	7.1	8.8	21.5	17.7	11.4	12.4	12.4	25.8	20.1	12.9	9.7	9.7	3.9	13.3	9.7	12.4	8.5	10.1	13.1
COBALT (6.98)	7.2	4.7	4.3	10.6	7.7	6.1	6	6.8	10.7	7.4	7.9	6.1	5.2	2.2	7.7	4.6	5.8	4.9	4.6	5.8
COPPER (10.5)	8	4.6	4.2	12.5	8	7.5	7	7.9	14.1	11.2	8.4	6.9	4.3	2.7	6.9	4.9	5.9	7.1	5.8	8.1
LEAD (15.1)	3.4	3.5	1.7	5.2	4.2	4.3	3.4	4	12.9	12.9	3.7	2.7	2.4	1.1	3.8	3.3	3.4	3	2.7	4
MANGANESE (291)	261	210	183	411	280	309	237	387	327	279	313	240	228	109	238	126	211	184	137	297
MERCURY (0.22)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL (15.3)	7.1	4.2	4.7	12.4	14	9	10.3	10.7	16	15.5	7.4	7.2	5.5	3.8	9.7	5.6	8.4	7.6	7	11.9
SELENIUM (0.32)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VANADIUM (71.8)	41.4	25.1	28.5	70.4	55.1	38.5	36.4	35.7	73.3	54.4	45.2	34.8	32.8	14.1	45.2	28.6	37.6	28.8	33.9	37.9
ZINC (77.9)	50.5	30.7	27.1	75.4	47.2	37.5	41.9	39.7	72.8	59.2	55.6	41.7	33.5	16	39	34.2	40.3	28.8	37.6	43.4

UNIT 2 PHASE II	16B104D												
	20'-22'	25'-27'	30'-32'	40'-42'	60'-62'	80'-82'	100'-102'	120'-122'	131'-133'	140'-142'	170'-172'	175'-177'	180'-182'
ALUMINUM (14800)	16500	9860	24500	10900	17200	16400	17100	8310	12400	10300	6010	8410	10100
ANTIMONY (3.06)	~	~	7.4	~	ND	~	~	~	~	~	~	~	~
BARIUM (173)	216	142	190	103	121	81.5	164	83.7	85.3	109	77.2	101	116
BERYLLIUM (0.669)	0.52	0.33	0.62	ND	0.42	ND	0.44	ND	ND	ND	ND	ND	ND
CADMIUM (2.35)	0.62	0.43	0.28	0.36	0.56	ND	ND	0.6	0.54	0.71	0.47	2.3	0.71
CHROMIUM (26.9)	15.5	9.7	20.3	11	16.8	16.5	17	9.3	12.9	10.9	8.1	10.7	12.6
COBALT (6.98)	9.3	5.6	7.6	5.7	8.2	6.9	7.5	3.9	5.1	6.2	4.2	4.9	6
COPPER (10.5)	10.3	6.6	7.1	5	10	6.2	8	4.2	7.2	7.1	4.4	6.3	9.8
LEAD (15.1)	4.1	2.9	369	3	4.2	3.6	3.9	2	3.1	3.3	52.3	2.5	3.3
MANGANESE (291)	339	206	196	214	331	204	182	138	208	391	190	194	276
MERCURY (0.22)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL (15.3)	9.2	6.2	8.9	5.5	9.6	15.6	7.9	5.1	8.4	11	7.8	10.3	12.7
SELENIUM (0.32)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND
VANADIUM (71.8)	53.2	34.4	58.1	36.3	54.1	51.9	45.1	29	37.9	35.8	29.4	32.4	38.1
ZINC (77.9)	64.3	39.1	49.1	33.5	60	48.7	51.6	25.6	39.5	36.3	28	36.2	44.3



UNIT 1 PHASE I	16_25B212			16_DBMW52					
	15'	20'	25'	13'	18'	23'	33'	53'	168'
ALUMINUM (14800)	5310	11300	19300	4790	21000	14600	6860	5810	26900
ANTIMONY (3.06)	ND	ND	ND	ND	ND	ND	ND	ND	ND
BARIUM (173)	90.4	199	254	96.3	308	201	111	143	268
BERYLLIUM (0.669)	ND	ND	0.9	0.2	0.83	0.5	0.31	0.23	1
CADMIUM (2.35)	0.52	1.1	1.5	0.73	1.8	1.3	0.52	0.88	4.3
CHROMIUM (26.9)	5.3	11.6	19.6	6.8	20.7	14.1	8.2	7.1	33.3
COBALT (6.98)	2.6	6.7	9.4	2.2	12.2	7	3.2	2.8	9.9
COPPER (10.5)	5.7	8.4	15.1	5.4	15.7	10.1	4	5	20.1
LEAD (15.1)	1	2.1	3.7	0.86	2.9	3	1.3	1.5	4.4
MANGANESE (291)	157	315	417	162	450	326	196	234	507
MERCURY (0.22)	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL (15.3)	3.7	7.8	13.6	3.1	16.8	12.4	6.5	9.6	28
SELENIUM (0.32)	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	0.55	0.67	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	0.17	0.26	0.63	ND	ND	ND	ND	ND	ND
VANADIUM (71.8)	21.7	42.1	66.3	22.8	68.3	48.7	26.3	25.9	82.7
ZINC (77.9)	24.9	56.3	83.9	26.6	94.8	64	28.2	31.1	104

UNIT 2 PHASE II	16B205							16B206									
	20'-22'	40'-42'	55'-57'	60'-62'	80'-82'	100'-102'	115'-117'	10'-12'	30'-32'	50'-52'	70'-72'	90'-92'	110'-112'	130'-132'	150'-152'	170'-172'	190'-192'
ALUMINUM (14800)	8460	8110	2530	8590	5860	15700	15800	14000	11200	6740	8620	10500	13800	17800	4680	5400	6740
ANTIMONY (3.06)	0.84	ND	ND	ND	ND	~	~	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND
BARIUM (173)	131	162	88.1	136	46.6	250	154	146	102	172	133	64.6	127	198	51.5	59.3	103
BERYLLIUM (0.669)	0.3	0.24	0.1	0.27	0.27	0.49	0.47	0.41	0.38	0.21	0.3	0.36	0.51	0.67	0.23	ND	0.36
CADMIUM (2.35)	ND	ND	ND	ND	ND	2	0.42	0.21	ND	0.2	0.27	ND	2.1	1.4	0.13	0.46	2
CHROMIUM (26.9)	8.5	8.9	2.9	9.6	6.9	16.7	17.9	13.3	11.2	7.6	10.1	9.3	17.5	21.2	5	8.1	9.6
COBALT (6.98)	5.3	4.5	1.5	4.5	3.2	5.4	7.4	7.4	5.1	4	4.9	5.1	7.8	8.4	2.6	3.3	5.3
COPPER (10.5)	9.7	4.4	1.8	5.4	4.3	6.9	8.5	7.4	4.9	4	5.5	4.5	9.4	11.3	3.2	5.6	6.4
LEAD (15.1)	2.7	2.2	0.97	2.4	2.5	3.2	4.1	3.5	4.2	3.5	2.6	2.7	7.4	4.6	1.9	1.3	2.5
MANGANESE (291)	207	262	82.8	258	144	184	300	302	157	175	188	204	299	387	100	137	237
MERCURY (0.22)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL (15.3)	5.8	5	2.4	5.8	6.8	8.2	11.6	7.8	6.1	4.5	8	5.8	15.1	16.5	4.1	7.3	
SELENIUM (0.32)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER (0.539)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
THALLIUM (0.42)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND
VANADIUM (71.8)	34.1	29.2	11.2	32	24.3	45.3	50	43	33	26.6	34.6	38.8	53.9	57.7	17.6	26.2	29
ZINC (77.9)	35.2	28.3	10.4	30.7	22.4	43.2	50.9	48.5	29.4	24.3	33.1	31.9	56	66.1	15.5	25.2	33

UNIT 2 PHASE II	16_AB213				
	20'	30'	40'	50'	60'
ALUMINUM (14800)	11300	13200	1040	13700	3250
ANTIMONY (3.06)	ND	3.5	ND	3.2	3.6
BARIUM (173)	150	158	146	183	93.4
BERYLLIUM (0.669)	0.39	0.48	0.54	0.54	0.65
CADMIUM (2.35)	ND	0.99	ND	ND	ND
CHROMIUM (26.9)	11.3	13.8	11.4	14.8	6.1
COBALT (6.98)	6.6	7.6	6.2	8.2	9.2
COPPER (10.5)	5.4	7.4	8.2	9.9	3.6
LEAD (15.1)	3.6	3.3	3.7	4.3	4.7
MANGANESE (291)	246	273	134	293	97.6
MERCURY (0.22)	0.16	0.24	0.17	0.1	0.25
NICKEL (15.3)	4.6	7.5	5.3	11.4	7.6
SELENIUM (0.32)	ND	ND	5.5	8.8	ND
SILVER (0.539)	0.42	ND	ND	0.71	0.49
THALLIUM (0.42)	ND	ND	ND	ND	ND
VANADIUM (71.8)	37.1	45.2	33.1	42.8	48.1
ZINC (77.9)	42.5	51.9	38	55.3	61.7

LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

PHASE I MONITORING WELL

PHASE I DEEP OR ANGLE BORING

PHASE II DEEP BORING

SAMPLE LOCATION

UNIT 1 PHASE I	16_25B212		
	15'	20'	25'
ALUMINUM (14800)	5310	11300	19300

DEPTH (IN FEET) SAMPLE TAKEN

ANALYTE

BACKGROUND CONCENTRATION

REPORTED CONCENTRATION

COLOR VALUES EXCEED THE RESPECTIVE BACKGROUND CONCENTRATIONS

NOTES:

ALL VALUES ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

COMMONLY OCCURRING METALS CONSIDERED ESSENTIAL NUTRIENTS (CALCIUM, IRON, MAGNESIUM, POTASSIUM, AND SODIUM) ARE NOT IDENTIFIED ON THIS FIGURE

ND = NOT DETECTED
- = NOT ANALYZED
~ = DATA DETERMINED UNUSABLE BY VALIDATION CONTRACTOR

NORTH
TRUE
N

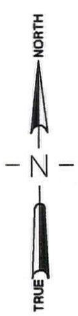
0 100 200
FEET

Record of Decision
Figure 5-12
Total Metals Above Background in Deeper Subsurface Soil

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045A9868
Job No: 23818-045
Rev No: C



0 330

APPROXIMATE SCALE IN FEET

SOURCE: AERIAL PHOTOBANK, INC.
SAN DIEGO, CALIFORNIA
DATE: 12/30/80

Record of Decision
Figure 5-13
Site Aerial Photograph (12/30/80)
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045E9869
Job No: 23818-045
Rev No: C

laboratory to screen for VOCs and total petroleum hydrocarbons (TPH). Selected soil samples collected within Units 1 and 2 were analyzed at a fixed-base laboratory for dioxins and dibenzofurans, phosphorus, PAHs, TAL metals, TPH, and VOCs. Soil samples collected from within Unit 3 were analyzed at a fixed-based laboratory for PAHs, TAL metals, and TPH. Selected samples from one boring within Unit 2 were also analyzed for total organic carbon.

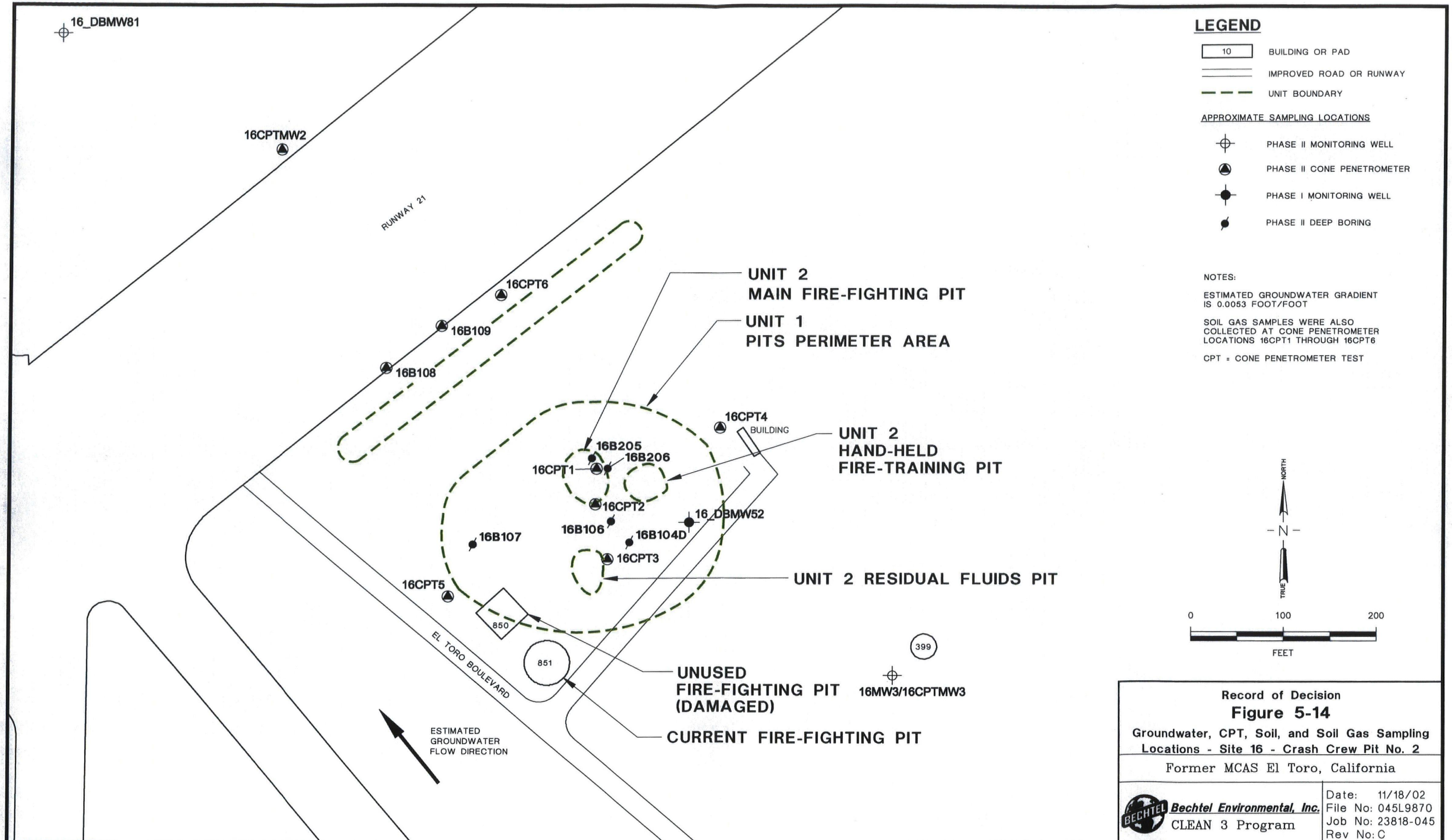
Analytical results for shallow soil samples are shown on Figures 5-5 through 5-8 and summarized below.

- Thirty-three VOCs were reported in 9 shallow soil samples from Units 1 and 2 at concentrations from less than 10 μg/kg to greater than 7,000 μg/kg.
- Between 3 and 12 PAHs were reported in 11 shallow soil samples from Units 1 through 3 at concentrations from less than 10 μg/kg to greater than 15,000 μg/kg.
- Trace (low mg/kg) to high (greater than 10,000 mg/kg) concentrations of TPH as diesel, gasoline, and/or motor oil were reported in 10 shallow soil samples collected at locations sitewide.
- Twelve of the 23 TAL metals were reported at concentrations above their respective background values in shallow soil samples at Site 16.
- Phosphorus was reported at concentrations ranging from 47.9 to 454 mg/kg in the 29 shallow soil samples analyzed for this parameter.

Analytical results for deeper subsurface soil samples are shown on Figures 5-9 through 5-12 and summarized below.

- Fifteen VOCs were reported in 24 samples from the 5 deep borings within Units 1 and 2 at concentrations from less than 1 μg/kg to greater than 10,000 μg/kg.
- Fifteen PAHs were reported in 12 soil samples from 3 of the 5 deep borings at concentrations from less than 10 μg/kg to 30,000 μg/kg.
- Trace to high concentrations of diesel and/or gasoline were reported in 17 soil samples from 4 of the 5 deeper subsurface borings within Units 1 and 2.
- Eleven of the 23 TAL metals were reported at concentrations above their respective background values in deeper subsurface soil samples at Site 16.
- Phosphorus was reported at concentrations from 21.9 mg/kg to 2,470 mg/kg in 50 deeper subsurface soil samples from Units 1 and 2 analyzed for this parameter.

Phase II groundwater samples were collected from three monitoring wells, two soil borings, and two CPT locations at Site 16 (Figure 5-14). The groundwater samples were analyzed in the field using an on-site mobile laboratory to screen for VOCs. Four groundwater samples were also transmitted to a fixed-base laboratory for VOC confirmation analyses. Results are shown on Figure 5-15. Three VOCs were reported (1,1-dichloroethene [DCE]; 1,1,2-trichloro-1,2,2-trifluoroethane; and TCE), with TCE reported the most frequently and at the highest concentration.



Record of Decision

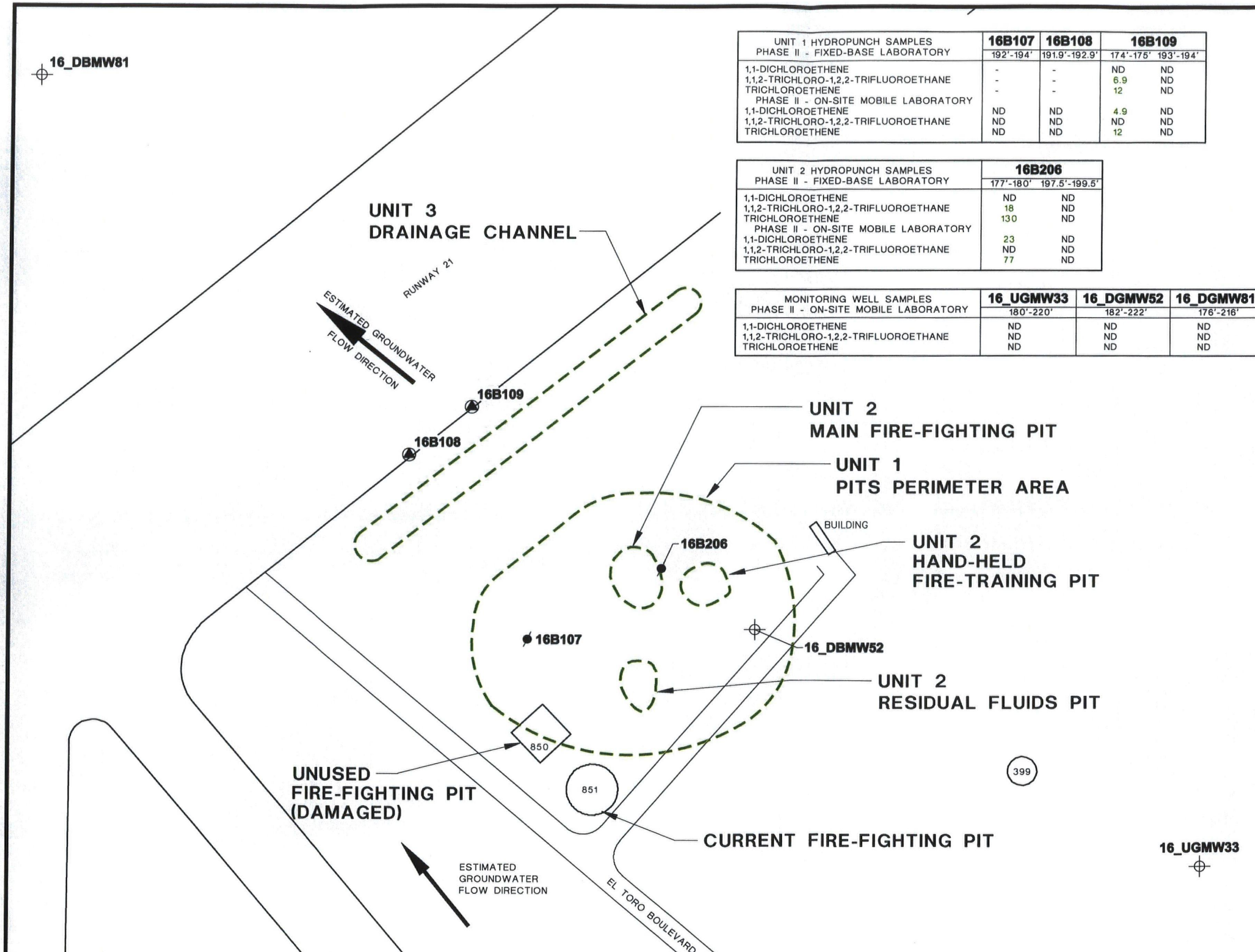
Figure 5-14

Groundwater, CPT, Soil, and Soil Gas Sampling Locations - Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045L9870
Job No: 23818-045
Rev No: C



UNIT 1 HYDROPUNCH SAMPLES PHASE II - FIXED-BASE LABORATORY	16B107	16B108	16B109	
	192'-194'	191.9'-192.9'	174'-175'	193'-194'
1,1-DICHLOROETHENE	-	-	ND	ND
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	-	-	6.9	ND
TRICHLOROETHENE	-	-	12	ND
PHASE II - ON-SITE MOBILE LABORATORY				
1,1-DICHLOROETHENE	ND	ND	4.9	ND
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	12	ND

UNIT 2 HYDROPUNCH SAMPLES PHASE II - FIXED-BASE LABORATORY	16B206	
	177'-180'	197.5'-199.5'
1,1-DICHLOROETHENE	ND	ND
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	18	ND
TRICHLOROETHENE	130	ND
PHASE II - ON-SITE MOBILE LABORATORY		
1,1-DICHLOROETHENE	23	ND
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	ND	ND
TRICHLOROETHENE	77	ND

MONITORING WELL SAMPLES PHASE II - ON-SITE MOBILE LABORATORY	16_UGMW33	16_DGMW52	16_DGMW81
	180'-220'	182'-222'	176'-216'
1,1-DICHLOROETHENE	ND	ND	ND
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND

LEGEND

10 BUILDING OR PAD

IMPROVED ROAD OR RUNWAY

UNIT BOUNDARY

APPROXIMATE SAMPLING LOCATIONS

PHASE I MONITORING WELL

PHASE II DEEP BORING (HYDROPUNCH)

PHASE II CONE PENETROMETER (HYDROPUNCH)

SAMPLE LOCATION

UNIT 1 PHASE II	16B109	
	174'-175'	193'-194'
1,1-DICHLOROETHENE	4.9	ND

DEPTH (IN FEET) SAMPLE TAKEN

ANALYTE

COLOR NUMBER INDICATES DETECTION

CONCENTRATION

NOTES:

ALL VALUES ARE IN MICROGRAMS PER LITER (µg/L)
ND = NOT DETECTED
- = NOT ANALYZED
VOC = VOLATILE ORGANIC COMPOUND

ESTIMATED GROUNDWATER GRADIENT IS 0.0053 FOOT/FOOT

NORTH
N
TRUE

0 100 200
FEET

Record of Decision
Figure 5-15
VOCs in Groundwater
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045A9871
Job No: 23818-045
Rev No: B

5.2.3.6 PREFEASIBILITY STUDY REPORT SAMPLING

In May through June 1999, soil gas samples were collected from varying depths at six locations (16CPT1 through 16CPT6) at Site 16 (Figure 5-14) to aid in the preparation of the draft FS Report. The depths from which the soil gas samples were collected were determined on the basis of location-specific lithology obtained from CPT lithologic logging prior to soil gas sample collection.

Results of the soil gas sampling were presented in the Site 16 FFS Report (BNI 2002b). The on-site analyses of soil gas samples indicated that concentrations of total VOCs in soil gas at the depths/locations sampled were from less than 1 μg/L to 828 μg/L (Table 5-1). The highest concentrations of total VOCs (828 μg/L) were reported at SG-01 (16CPT1) at 154 feet bgs. 16CPT1 was advanced through the center of the main pit. VOCs reported in soil gas samples included trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), 1,1-dichloroethane (DCA), cis-1,2-DCE, TCE, benzene, toluene, ethylbenzene, m- and p-xylenes, and o-xylene.

The soil gas sampling indicated that the highest concentrations of TCE in soil gas at Site 16 were present beneath the main pit (the primary source area). In addition, these concentrations increased with depth beneath the main pit with the highest concentrations reported at 154 feet bgs. In contrast, the highest concentrations of VOCs in soil were present above a depth of approximately 100 feet bgs.

Pre-FS Report groundwater sampling was also conducted at three wells installed during the field activities in July 1999. VOCs present in groundwater at concentrations exceeding 1 μg/L included chloroform, 1,2-DCA, methylene chloride, and TCE. Toluene was also reported at a concentration less than 1 μg/L. HydroPunch® sampling performed in May 1999 indicated that benzene, ethylbenzene, and xylenes were also present in groundwater at Site 16 at concentrations less than 15 μg/L.

5.2.3.7 MULTIPHASE EXTRACTION PILOT STUDY

As recommended in the Phase II RI Report, a draft FS Report was prepared to develop potential remedial alternatives for Site 16. The draft FS Report used MPE, a presumptive remedy for VOC-contaminated soil and groundwater, as the main component of the alternatives and recommended that a pilot study be conducted to evaluate the site-specific effectiveness of MPE at Site 16.

In accordance with these recommendations, an MPE pilot study was conducted at Site 16 from mid-October 2000 through April 2001. The results, which are discussed below, showed that MPE was effective in removing VOCs from soil but was not effective in removing VOCs from groundwater. The final FFS for Site 16 provides additional information on the MPE pilot study at Site 16 (BNI 2002b).

Volatile Organic Compound Mass Removed

The VOC mass removed from soil and groundwater during the MPE pilot study was calculated from VOC vapor concentrations and associated airflow rates and from dissolved VOC concentrations in groundwater and associated groundwater pumping rates obtained during testing. Figure 5-16 shows the total VOC and TCE mass removed from soil (approximately 127 and 72 pounds, respectively). Next to TCE, the largest contributor to the VOC mass was Freon 113 (46 pounds [not shown on figure]). Together, TCE and Freon 113 accounted for more than 90 percent of the total VOC mass removed from soil at Site 16.

Figure 5-17 shows the VOC and TCE mass removed from groundwater. As was the case for soil, TCE and Freon 113 accounted for more than 90 percent of the total VOC mass removed from groundwater. However, a total mass of only 0.19 pound of TCE and 0.02 pound of Freon 113 was removed from groundwater during the pilot study.

Rebound Testing

Rebound testing was performed to determine whether the lowered concentrations achieved during the MPE pilot study were stable or would rise when the system was turned off for an extended time. The testing showed that TCE concentrations in soil gas declined by approximately one order of magnitude as a result of the MPE pilot study and rose only slightly during the rebound test (Table 5-2). Rebound results for groundwater confirmed that TCE concentrations at the main pit area were not measurably affected by the MPE pilot study.

Confirmation Sampling

Confirmation sampling was conducted in January 2002 to address concerns about the vadose zone VOC concentrations over time and to verify the results from the MPE pilot study. An MPE Work Plan Addendum was developed to perform the additional sampling approximately 10 months after the MPE system was shut down. The intent of the confirmation sampling was to compare current data with the results from the post rebound sampling to determine whether the results were comparable and to identify any increases in soil gas concentrations. As shown in Table 5-2, the concentrations of VOCs reported during confirmation sampling appear to have remained comparable with previous results.

Recommended Follow-On Action

Based on the mass of VOCs removed from the vadose zone during the MPE pilot study, the FFS Report concluded that the existing concentrations of VOCs in the vadose zone are unlikely to load groundwater above the MCL for any of the reported VOCs. To confirm that TCE soil gas concentrations reported in the vadose zone (10 feet bgs to groundwater) following the MPE pilot study are not impacting groundwater, the FFS Report recommended additional vadose zone monitoring to verify concentrations do not increase over time.

Table 5-1
Summary of Field Analytical Results for Soil Gas Samples Collected in 1999 at Site 16
(units reported in micrograms per liter)

Soil Gas Sample	Sample ID	Sample Depth (feet bgs)	Sampling Date	Total VOCs	CFC-11	CFC-113	1,1-DCA	cis-1,2-DCE	TCE	Benzene	Toluene	Ethylbenzene	Total Xylenes
SG[a]-01	1786101-01	20	05/24/99	231	1 U	102	1 U	2	7	16	61	12	31
SG-01	1786105-02	41	05/24/99	415	4	338	2	4	10	15	29	5	8
SG-01	1786107-02	58	05/24/99	12	1 U	12	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-01	1786108-01	[b]	05/24/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-01	1786109-01	95	05/24/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-01	1786110-02	110	05/24/99	350	5 U	334	5 U	5 U	16	5 U	5 U	5 U	5 U
SG-01	1786111-01	[b]	05/25/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-01	1786112-01	123	05/25/99	50	1 U	47	1 U	1 U	3	1 U	1 U	1 U	1 U
SG-01	1786113-04A	139	05/25/99	608	8	543	1 U	2	55	1 U	1 U	1 U	1 U
SG-01	1786114-04B	154	05/25/99	828	12	744	5 U	5 U	72	5 U	5 U	5 U	5 U
SG-02	1786115-01	22	05/25/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-02	1786116-01	39	05/25/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-02	1786117-01	[b]	05/26/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-02	1786118-01	58	05/26/99	59	1 U	24	1 U	1 U	35	1 U	1 U	1 U	1 U
SG-02	1786119-01	95	05/26/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-02	1786120-01	138	05/26/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786121-01	20	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786122-01	[b]	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786123-01	38	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786124-01	58	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786125-01	88	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-03	1786126-01	119	05/27/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786127-01	[b]	06/01/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786128-01	49	06/01/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786129-02	58	06/01/99	8	1 U	8	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786130-01	115	06/01/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786131-01	141	06/01/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-04	1786132-01	155	06/01/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786133-01	49	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786134-01	[b]	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786135-01	58	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786136-01	103	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786137-01	116	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786138-01	142	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-05	1786139-01	160	06/02/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786140-01	39	06/03/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786141-01	[b]	06/03/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786142-02	51	06/03/99	81	1 U	81	1 U	1 U	1 U	1 U	1 U	1 U	1 U

(table continues)

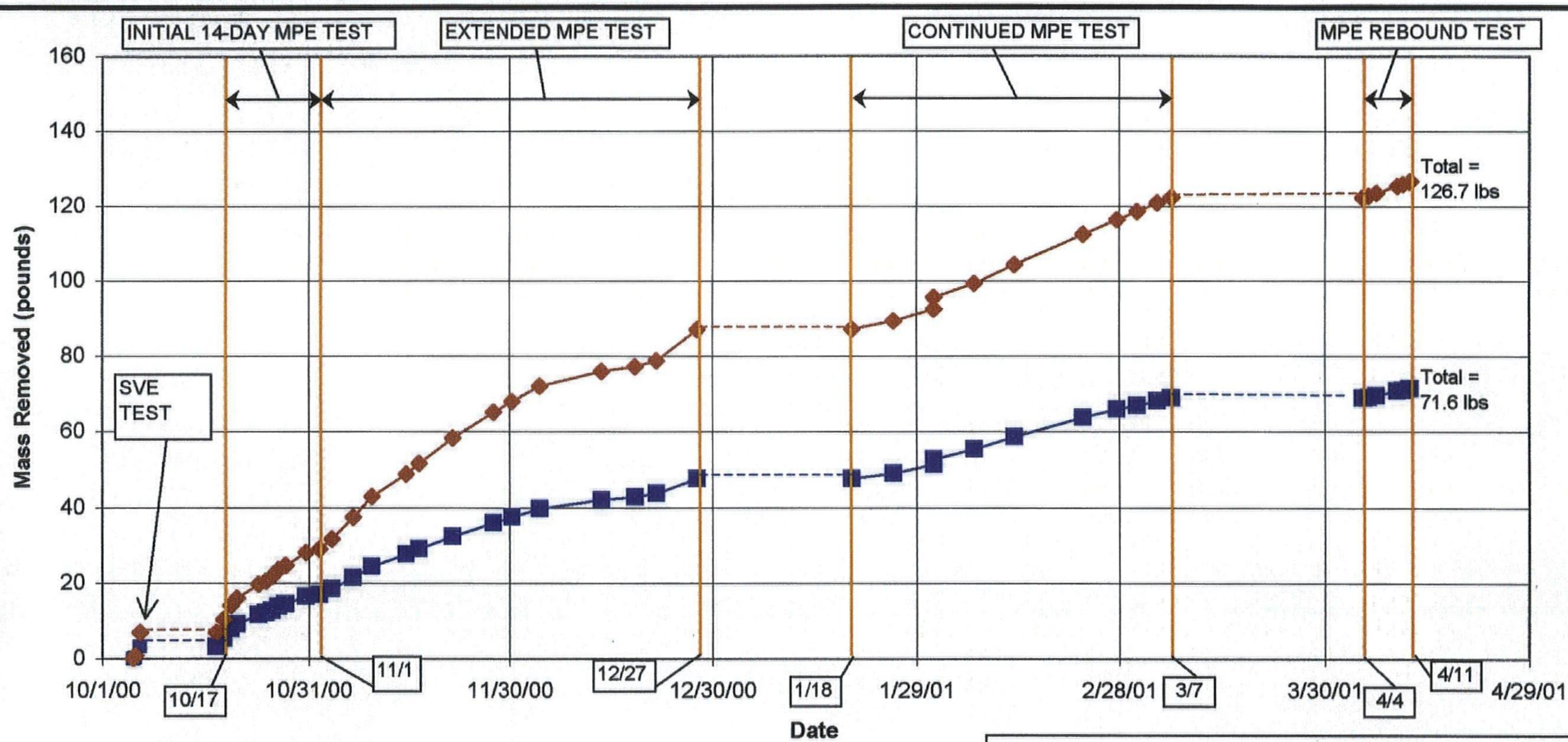
Table 5-1 (continued)

Soil Gas Sample	Sample Identification	Sample Depth (feet)	Sampling Date	Total VOCs	F-11	F-113	1,1-DCA	cis-1,2-DCE	TCE	Benzene	Toluene	Ethylbenzene	Total Xylenes
SG-06	1786143-01	93	06/03/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786144-01	122	06/03/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786145-01	149	06/03/99	8	1 U	8	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-06	1786146-01	156	06/03/99	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:
[a] SG-01 soil gas samples collected from 16CPT1
SG-02 soil gas samples collected from 16CPT2
SG-03 soil gas samples collected from 16CPT3
SG-04 soil gas samples collected from 16CPT4
SG-05 soil gas samples collected from 16CPT5
SG-06 soil gas samples collected from 16CPT6
[b] soil gas equipment blank

Acronyms/Abbreviations:
bgs – below ground surface
CFC-11 – trichlorofluoromethane
CFC-113 – 1,1,2-trichloro-1,2,2-trifluoroethane
DCA – dichloroethane
DCE – dichloroethene
SG – soil gas
TCE – trichloroethene
VOC – volatile organic compound

Review Qualifier:
U – compound not reported above detection limit



LEGEND:

- TCE Cumulative Mass Removed
- VOC Cumulative Mass Removed

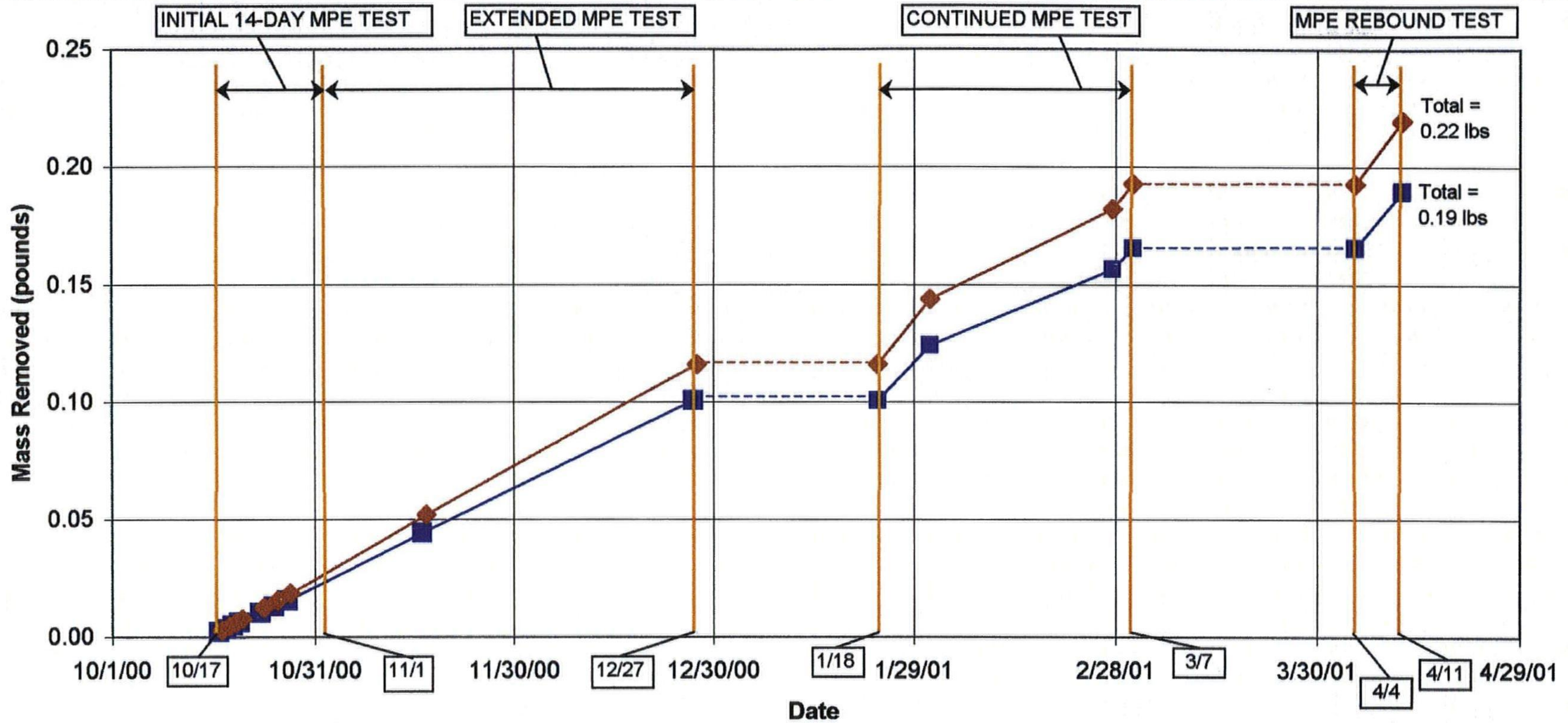
NOTES:
- Dashed lines represent periods when the MPE system was off.
- The MPE rebound test was conducted during the final week shown.

Record of Decision
Figure 5-16
Total TCE and VOC Mass Removed from Soil During MPE Pilot Testing
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date:	10/16/02
File No.:	fig5-16.xls
Job No.:	23818-045



LEGEND:

—■— TCE Cumulative Mass Removed

—◆— VOC Cumulative Mass Removed

NOTES:
- Dashed lines represent periods when the MPE system was off.
- Data collected in January through April 2001 include the total flow from wells 16MPE1, 16MW1, and 16MW6. Data collected prior to January 2001 are for well 16MPE1, which was the only well pumping.

Record of Decision
Figure 5-17
TCE and VOC Mass Removed from Groundwater During MPE Pilot Testing
Site 16 - Crash Crew Pit No. 2

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 10/16/02
File No.: fig5-17.xls

Job No.: 23818-045

Table 5-2
Summary of Analytical Results for Soil Gas Samples From Wells Under Static Conditions
(in micrograms per liter)

Sample ID	Sample Location (Well ID)	Condition	Collection Date	ANALYTE CONCENTRATION Total VOCs	cis-1,2-DCE	F-11	F-113	TCE	Xylenes
1788200	16MW6	Pre-MPE test	10/04/00	900	< 1	30	580	290	< 1
1788295		Prerebound test[a]	04/04/01	27.5	2.3	< 1	11	13	1.2
1788527		Postrebound test	04/12/01	46.1	1.1	< 1	17	28	< 1
1788535		Confirmation	01/31/02	44	< 1	< 1	11	33	< 1
1788201	16VM1	Pre-MPE test	10/04/00	557	< 1	21	460	76	< 1
1788297		Prerebound test	04/04/01	34.4	< 1	< 1	32	2.2	< 1
1788528		Postrebound test	04/12/01	39.7	< 1	< 1	38	1.7	< 1
1788529[b]		Postrebound test	04/12/01	36.8	< 1	< 1	35	1.8	< 1
1788536		Confirmation	01/31/02	31.5	< 1	< 1	27	4.5	< 1
1788202	16MW7	Pre-MPE test	10/04/00	129	< 5	< 5	75	54	< 5
1788296		Prerebound test	04/04/01	27.4	< 1	< 1	22	5.4	< 1
1788524		Postrebound test	04/12/01	19.5	< 1	< 1	1.9	14	3.6
1788537		Confirmation	01/31/02	63.2	< 1	< 1	54	9.2	< 1
1788203	16MW1	Pre-MPE test	10/04/00	152	< 5	< 5	120	32	< 5
1788294		Prerebound test	04/04/01	14.4	< 1	< 1	8.8	5.6	< 1
1788526		Postrebound test	04/12/01	2.5	< 1	< 1	< 1	2.5	< 1
1788534		Confirmation	01/31/02	NR[c]	< 1	< 1	< 1	< 1	< 1
1788204	16MPE1	Pre-MPE test	10/04/00	238.6	< 2.5	3.6	160	75	< 2.5
1788298		Prerebound test	04/04/01	35.6	1.6	<1	10	24	< 1
1788525		Postrebound test	04/12/01	11.1	< 1	< 1	< 1	10	1.1
1788532		Confirmation	01/31/02	46.2	< 1	< 1	2.4	44	< 1
1788533[b]		Confirmation	01/31/02	67.1	< 1	< 1	3.1	64	< 1
1788530	16MW4[c]	Static	01/31/02	NR	< 1	< 1	< 1	< 1	< 1
1788531	16MW5	Static	01/31/02	157.2	< 1	2.2	140	15	< 1

Notes:
[a] prerebound test samples collected after the MPE system had been shut off for 1 month
[b] duplicate sample
[c] VOCs were not reported above the detection limits, and vadose zone purging resulted in the water table being drawn over entire screen length

Acronyms/Abbreviations:
< – result is less than the detection limit indicated
DCE – dichloroethene
F-11 – Freon 11 (trichlorofluoromethane)
F-113 – Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)
MPE – multiphase extraction
TCE – trichloroethene
VOC – volatile organic compound

5.3 POTENTIAL MIGRATION PATHWAYS

The primary source of contamination at Site 16 appears to have been firefighter training exercises. During the training exercises, the main pit was filled with water and the water was covered with various mixtures of residual fuels and other combustible fluids. The surface was then ignited and extinguished by the firefighters. Water was used as the primary means of extinguishing the fires during the practice sessions. As a result of these activities, the potential migration pathways of contaminants are transport by air, surface water, soil infiltration (migration in the vadose zone), and groundwater (migration in the saturated zone). Figure 5-18 shows a conceptual site model for Site 16.

5.3.1 Air

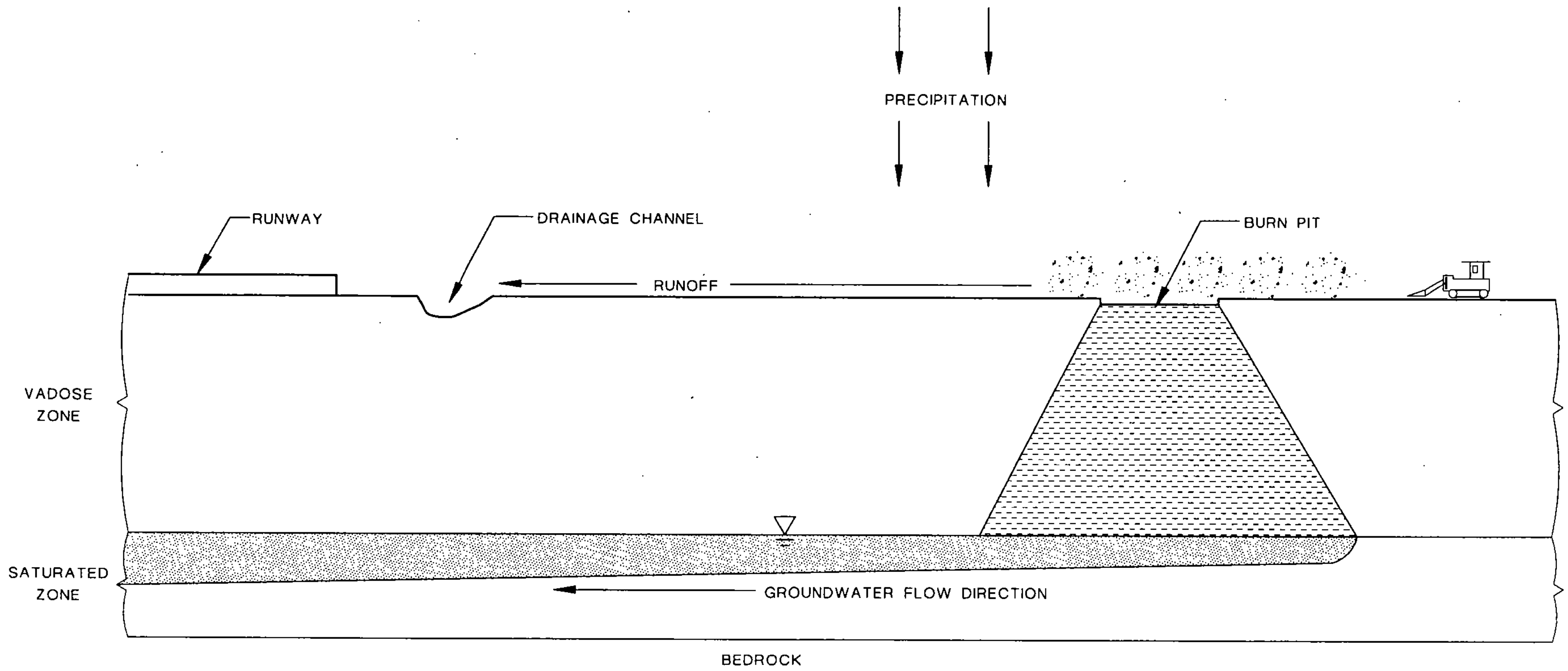
Airborne contaminants can be transported along with fugitive dust or by volatilization directly to the air. Wind speed, wind direction, and weather conditions affect the transport of dust through the air. Contaminants most likely to be transported with fugitive dust are compounds that are tightly sorbed to soil particles. At Site 16, these include TAL metals, SVOCs, and PAHs.

The surface stability of the area of contaminated soils at Site 16, however, is expected to minimize the potential for this transport mechanism to mobilize contaminants. Climatic conditions at the site most of the year, coupled with the soil characteristics, result in dry stable, hard-ground surface soil in the contaminated areas of Site 16. Because wind speeds in the region are light to moderate, they are generally insufficient to cause more than light-to-moderate erosion or transport of contaminated soils.

Volatilization into air depends on the concentration, extent, and vapor pressure of the volatile material; its proximity to the surface; and the barometric pressure. Contaminants most likely to be transported by volatilization at Site 16 would be VOCs. These can be released to air by volatilization from shallow soil, which may have been an important transport mechanism in the past when the site was in operation. Site 16 data show that VOCs are generally present in only trace (less than 10 μg/kg) concentrations in surface soil.

5.3.2 Surface Water

Waterborne contaminants can be transported in association with suspended particulates or as solutes or colloids in the surface water itself. Surface water transport is affected by the amount of rainfall, type of contaminant, surface properties, and the topography of the area. The surface water transport pathway allows movement of chemicals off-site to the surrounding area. Contaminants most likely to be transported in association with suspended colloids or particulates would be those compounds that are tightly sorbed to soil particles. At Site 16, these include TAL metals, SVOCs, and PAHs. Surface water runoff and sediment transport of contaminated soil may occur at Site 16, resulting in sediment transport to surrounding areas. However, the impact on the local environment and the receiving waters from Site 16 is expected to be limited for the following reasons.



LEGEND

RECEPTORS:

- WORKERS
- CONTAMINATED SOIL

PATHWAYS:

- GROUNDWATER
- DUST
- DISSOLVED PHASE CONTAMINANTS

NOT TO SCALE

Record of Decision

Figure 5-18

Conceptual Site Model

Site 16 - Crash Crew Pit No. 2

Former MCAS EL Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/18/02
File No: 045X9876
Job No: 23818-045
Rev No: B

- The soil contamination is restricted in lateral extent.
- Significant rainfall events producing sufficient overland flow to transport sediment are infrequent (12.2 inches of annual rainfall generally over a 6-month period).
- The surface relief of Site 16 is generally flat, ranging from 0 to 3 percent slope.
- The main burn pit, the area of highest soil contamination, is saucer shaped and is approximately 2 feet below grade at the center. (This topography tends to cause ponding of surface water and limits surface runoff.)
- The distribution of contamination at Site 16 does not support this pathway. (Concentrations of PAHs and petroleum hydrocarbons reported in shallow soils at Unit 3, the drainage swale, were orders of magnitude lower than concentrations reported in shallow soil in the area of the main burn pit.)

5.3.3 Infiltration

Organic chemicals in the soil have been subjected to downward movement by the leaching action of infiltrating water. Most of this downward movement likely occurred during the frequent use of the site as a firefighter training area. Repeated flooding of the main burn pit area with water induced unusually high fluxes of infiltration in this isolated area that are not typical of natural conditions at Former MCAS El Toro. With the cessation of these activities, most of the downward leaching likely ceased. Only the most mobile and relatively persistent of the site-related chemicals (primarily TCE) appear to have reached groundwater. Less mobile and/or less persistent chemicals (e.g., toluene, xylene, and naphthalene) appear to have been attenuated by biodegradation or sorption to vadose zone soil.

5.3.4 Vapor Movement

The results of the soil gas sampling indicate that the highest concentrations of TCE in soil gas at Site 16 are present beneath the main pit, and these concentrations increase with depth with the highest concentrations reported at 154 feet bgs. In contrast, the highest concentrations of VOCs (including TCE) in soil are present above a depth of approximately 100 feet bgs.

The explanation for this situation is likely related to several site conditions. First, the firefighting training activities that took place at Site 16 released the contaminants into the subsurface at Site 16 as a mixture. This mixture appears to have consisted primarily of petroleum fuels with the lighter fraction of hydrocarbon compounds stripped off by combustion and solvents that consisted primarily of TCE. This mixture infiltrated into the subsurface with the large volumes of water used during firefighting training. These activities ceased approximately 15 years ago and present site conditions, with low average rainfall and high evapotranspiration rates, are generally not conducive to leaching of contaminants to groundwater.

Therefore, it is likely that the majority of VOC contaminants that were released into the subsurface have passed through the vadose zone into the groundwater. This scenario is, to some extent, substantiated by reported TCE concentrations in soil gas; during the Phase II RI, it was found that the TCE concentrations (approximately 6 feet above the present water table) did not appear to be high enough to load groundwater to the present TCE concentrations in groundwater.

Secondly, as stated above, the TCE that was released into the subsurface at Site 16 was released with petroleum hydrocarbon fuel. TCE within a mixture of fuels will likely exhibit behavioral characteristics in the subsurface different from those of TCE released by itself. One of the characteristics of this mixture appears to be that, because the TCE is mixed with petroleum fuels, less TCE is available for partitioning to soil gas. Site-specific data appear to substantiate this theory. Beneath the main pit (primary source area), the highest concentrations of TCE in soil (4,400 µg/kg) were present at 60 feet bgs while the highest TCE concentrations in soil gas (72 µg/L) were present at a depth of 154 feet bgs. Furthermore, at the same depth at which the concentrations of petroleum hydrocarbons dropped off (approximately 110 feet bgs), the concentrations of TCE in soil gas increased (Figures 5-9 and 5-11). Petroleum hydrocarbons in soil at Site 16 are being addressed under the former MCAS El Toro Petroleum Corrective Action Program.

5.3.5 Groundwater

This section is specific to VOCs because they were the only site-related contaminants reported in groundwater. In the saturated zone, VOCs can exist in the following three phases:

- sorbed onto soil particles
- as a solute in groundwater
- as dense nonaqueous-phase liquid (DNAPL)/light nonaqueous-phase liquid (LNAPL)

The sorption behavior of VOCs in the saturated zone is similar to that described above for the vadose zone, but the transport mechanisms are different.

The mechanisms controlling transport of constituents dissolved in groundwater are advection, hydrodynamic dispersion, and molecular diffusion. Advection is the transport of solutes by the bulk motion of groundwater. Hydrodynamic dispersion is the mechanical mixing (and spreading) of groundwater and its constituents as they flow through the pore space of the soil. Molecular diffusion is the spreading out of molecules to equalize concentrations in a medium.

The nature of the firefighter training exercises (fuels spread on ponded water) resulted in a tendency to produce only aqueous solutions of residual chemicals. No other site historical information suggests that pure DNAPL/LNAPL VOCs infiltrated soil at Site 16. In addition, VOC concentrations in groundwater are at least three orders of magnitude lower than the concentration necessary (e.g., near saturation) to suggest that

DNAPL/LNAPL currently exists. As a result, it is expected that DNAPL/LNAPL VOCs are not present in groundwater beneath Site 16 (BNI 1997). Because of their mobility, VOCs at Site 16 are expected to remain in the aqueous phase, attenuate, and continue to be transported by groundwater.

Section 6
CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

This section contains a description of the current and potential future use of land, groundwater, and surface water at Former MCAS El Toro.

6.1 CURRENT LAND USE

Former MCAS El Toro is bordered on the south and west by the city of Irvine and on the north and east by unincorporated lands. The local jurisdictions do not have authority over federal lands. At its maximum acreage, the base comprised about 4,740 acres. Approximately 1,000 acres have been transferred or are pending transfer at this time. In 1998, approximately 25 acres in the southeastern portion of the Station were transferred to the California Department of Transportation. In 2001, approximately 901 acres in the northeast portion of the base were transferred to the Federal Aviation Administration. The remaining 74 acres pending transfer are also located in the northeast portion of the base and are scheduled to be transferred to the Federal Bureau of Investigation. Portions of the lands along the perimeter of the Station are outleased and used for agricultural purposes, including landscape nurseries, livestock grazing, and crop production.

Former MCAS El Toro provided materials and support for Marine Corps aviation activities until the Station was closed in July 1999. Environmental compliance and restoration activities have continued since Station closure, and a caretaker staff will remain at the Station until property transfer is complete.

During operations, land use on Former MCAS El Toro consisted of a few general types. General Station land uses are described below for the following four quadrants, as defined by the bisecting north-south and east-west runways.

- The northwestern quadrant consisted of the Former MCAS El Toro headquarters, administrative services, family and bachelor housing, and community support services.
- The northeastern quadrant consisted of Marine Aircraft Group activities (e.g., training, maintenance, supply and storage, and airfield operations), family housing, community support services, and ordnance storage in areas isolated by topographic relief and distance from other developments.
- The southeastern quadrant consisted of administrative services, maintenance facilities, ordnance storage, and the golf course.
- The southwestern quadrant consisted of aircraft maintenance facilities, supply and storage facilities, and limited administrative services.

Historically, land use around Former MCAS El Toro has been largely agricultural. However, land to the south, southeast, and southwest has been developed over the past 10 to 15 years for commercial, light-industrial, and residential uses. Currently, expanding commercial areas adjoin the Station and additional residential areas are located to the northwest and west. Adjacent land to the northeast and northwest is used for agriculture.

Site 16 is located in the northwest quadrant of Former MCAS El Toro. The site was historically used as a crash crew (firefighter) training area. Site 16 is not currently in use.

Following closure, the DON finalized an Environmental Impact Report/Environmental Impact Study in March 2002 to evaluate several alternatives for the reuse of the Station. The DON is currently working with the local community to determine an appropriate alternative for the Station. At this time, the most likely reuse of Site 16 is recreational (park).

6.2 GROUNDWATER USES

Former MCAS El Toro lies within the Irvine Forebay I Groundwater Subbasin (Irvine Subbasin), which has been designated by RWQCB as a public water supply source (RWQCB 1995). The regional aquifer beneath Former MCAS El Toro is not currently a source of municipal drinking water because of widespread elevated concentrations of total dissolved solids (TDS) and nitrates that exceed water quality standards; however, groundwater in the vicinity of the Station is used for agricultural purposes. One on-Station groundwater well (18-TIC055), located at the westernmost end of the east-west runway, belongs to the Irvine Company and is used for irrigation. It is connected to the regional irrigation distribution system. Eight other irrigation wells are located in the vicinity of the Station (Figure 6-1).

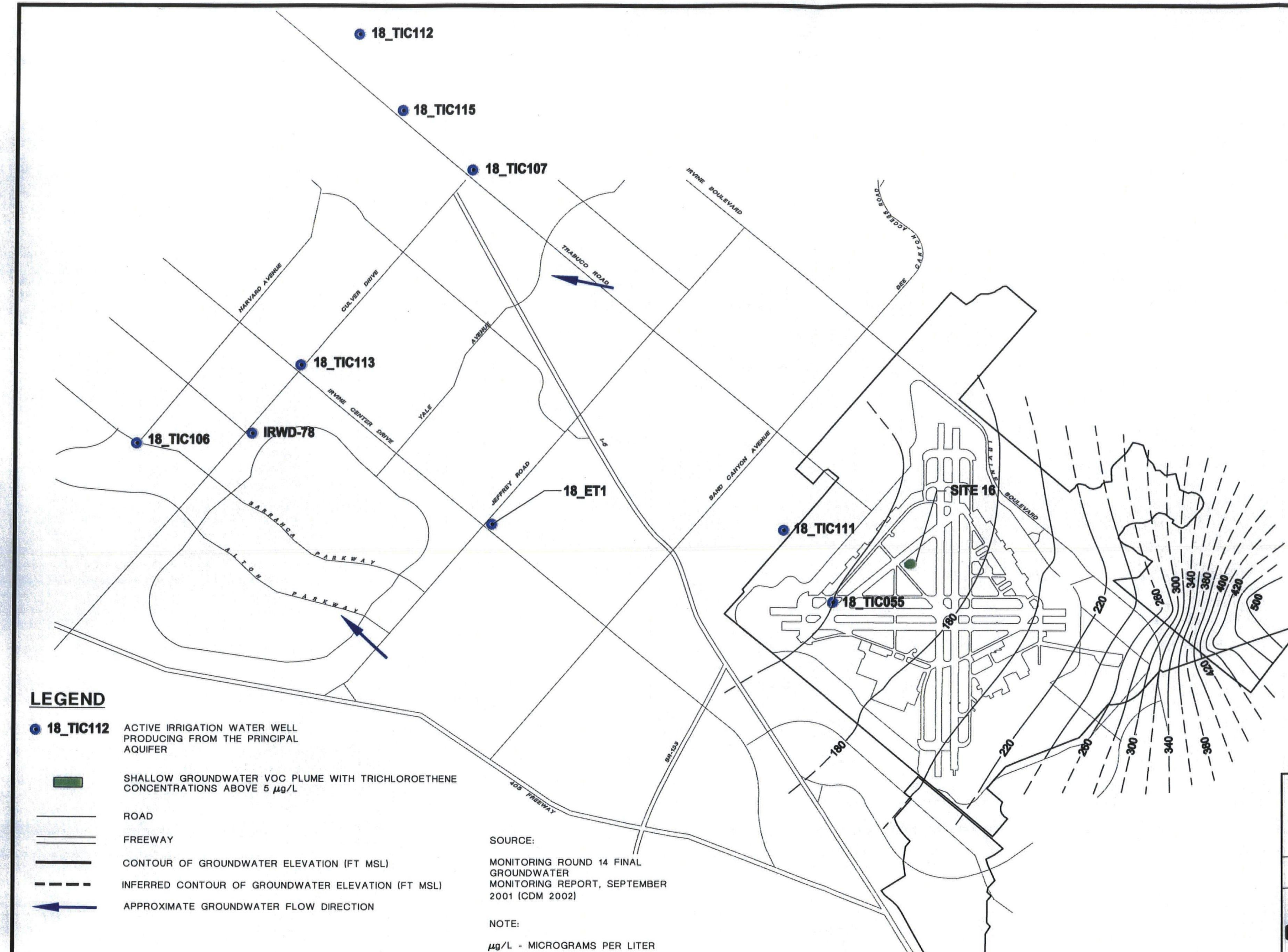
Groundwater within the Irvine Subbasin currently contains high concentrations of TDS and nitrates that make it unsuitable for drinking water purposes. OCWD and Irvine Ranch Water District have initiated the Irvine Desalter Project to intercept, contain, and treat this groundwater to make it suitable for domestic or recycled water purposes.

6.3 SURFACE WATER USES

Surface drainage near Former MCAS El Toro generally flows southwest, following the slope of the land and perpendicular to the trend of the Santa Ana Mountains. Several washes originate in the hills northeast of Former MCAS El Toro and flow through or adjacent to the Station en route to San Diego Creek. Off-Station drainage from the hills and upgradient irrigated farmlands combines with Station runoff at Former MCAS El Toro and flows into four major drainage channels: Borrego Canyon Wash, Agua Chinon Wash, Bee Canyon Wash, and Marshburn Channel. Site 25 comprises these on-Station drainages.

The southernmost drainage channel is Borrego Canyon Wash, which flows along the southeastern boundary of Former MCAS El Toro. Borrego Canyon Wash crosses the southern corner of the Station and joins Agua Chinon Wash about 1/4 mile downstream from the Station boundary.

Both the Agua Chinon and the Bee Canyon Washes cross the central portion of Former MCAS El Toro and receive on-Station runoff, mainly through storm sewers. Agua Chinon Wash flows into San Diego Creek just east of the intersection of the San Diego and Laguna Beach Freeways, about 1 mile downstream from its confluence



Record of Decision

Figure 6-1

Active Irrigation Water Wells in the Vicinity of Former MCAS El Toro

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/19/02
File No: 045A9872
Job No: 23818-045
Rev No: C

with Borrego Canyon Wash. Bee Canyon Wash flows into San Diego Creek just northeast of the same intersection, about 1,500 feet north of Agua Chinon Wash.

Marshburn Channel runs along the northwestern boundary of Former MCAS El Toro. The channel receives runoff from upstream agricultural fields and from the western part of the Station and discharges into San Diego Creek about 3/4 mile northwest of Bee Canyon Wash.

Southwest of Former MCAS El Toro, the San Diego Creek flows through commercial and agricultural areas. Approximately 5 miles downstream from the Station, the creek runs through a recreational area that includes hiking and bicycle paths. The creek flows into Upper Newport Bay about 7 miles downstream from its intersection with the Marshburn Channel. Recreational uses of the bay include swimming and fishing. Upper Newport Bay is an ecological preserve used by migratory birds (BNI 1995).

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Section 7
SUMMARY OF SITE RISKS

An HHRA was conducted for Site 16 using data collected during the Phase II RI. The objective of the risk assessment was to evaluate whether exposure to chemicals found in soil and/or groundwater pose a threat to human health if no action is taken. The HHRA methodology is provided in the OU-3A RI Report (BNI 1997) and summarized below. An ecological risk assessment was not performed for Site 16 because a habitat assessment performed in May 1995 indicated an absence of significant plant and wildlife habitat at this site (BNI 1997).

7.1 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The procedures used to identify the COPCs to be evaluated in the risk assessment were consistent with U.S. EPA's Risk Assessment Guidance for Superfund (U.S. EPA 1989) and Interim Final Guidance for Data Usability in Risk Assessment (U.S. EPA 1990). Surface soil data (0 foot to 2 feet bgs) and shallow soil data (0 foot to 10 feet bgs) were used to select COPCs in the baseline HHRA. Exposure to groundwater was also evaluated because the RI Report indicated that site-related contamination extends to groundwater at the site.

For this HHRA, Site 16 was separated into the following three areas of potential concern:

- Units 1 and 2, Pit Perimeter Area and Fire-Fighting Pits
- Unit 3, Drainage Channel
- groundwater

Unit 3 and groundwater were addressed as separate areas of potential concern so necessary remedial actions could be developed for relatively localized remediation targets.

7.1.1 Soil Data

COPCs were identified for soil in areas of potential concern based on surface soil data collected from 0 foot to 2 feet bgs and shallow soil data collected from 0 foot to 10 feet bgs (Table 7-1). Data used to identify COPCs consisted of 68 soil samples from Units 1 and 2 and 26 soil samples from Unit 3. Chemicals reported in soil samples from more than 10 feet bgs are not included on the COPC list because these chemicals do not have complete exposure pathways.

Phase I and Phase II RI data from samples collected within the site boundaries were used to identify the COPCs at each area of potential concern at Site 16. At Units 1 and 2, 31 analytes were identified as surface soil COPCs and 60 analytes were identified as shallow soil COPCs. At Unit 3, 19 analytes were identified as surface soil COPCs and 22 analytes were identified as shallow soil COPCs. All organic analytes identified in surface soil were also present in shallow soil. Metal concentrations in soil were statistically compared with Former MCAS El Toro background concentrations to identify site-related analytes. Inorganic nutrient metals (calcium, iron, magnesium, potassium, and sodium) were excluded as COPCs. Table 7-1 presents the COPCs identified for each area of potential concern.

During the Phase II RI conducted from 1995 through 1997 for OU-3A Sites 4, 6, 8 through 13, and 15 and OU-3B Site 16, soil samples were collected from borings at four sites to estimate the relative contribution of hexavalent chromium to the total chromium concentrations reported for these sites. The analytical results did not identify hexavalent chromium in any of these soil samples. Therefore, for the purposes of evaluating data during the Phase II RI for risk assessment, contamination fate and transport, and nature and extent of contamination, chromium was assumed to be present only in its trivalent state (BNI 1997).

7.1.2 Groundwater Data

COPCs were identified for groundwater at Site 16 based on data from four HydroPunch samples collected from two locations at the site. Only Phase II RI data were used to identify the groundwater COPCs at Site 16. The chemicals selected as groundwater COPCs are listed in Table 7-1. Only two organic analytes were identified as groundwater COPCs. (Note: Based on the results of soil samples collected from Site 16, 1,4-dioxane was not identified as a COPC for groundwater and, therefore, was not included in the suite of analytes.)

7.1.3 Air Data

Conservatively, volatile COPCs for air were identified from surface soil VOC data. Soil particulate COPCs were also identified from soil samples. Soil chemicals other than the VOCs were identified as air particulate COPCs.

7.2 EXPOSURE ASSESSMENT

An exposure assessment identifies the populations at potential risk and the mechanisms by which members of those populations could be exposed to the COPCs in each medium. It is also a process by which the chemical concentrations at the point of exposure and the chemical doses are calculated.

7.2.1 Exposure Scenarios

Because Former MCAS El Toro is a closed facility, the exposure assessment focused on people who might be exposed to contaminants while they live, work, or play directly on each site. Exposure of people who live, work, or play in communities surrounding Former MCAS El Toro is possible through movement of chemical vapors and contaminated dust from the Station to off-Station areas. However, even if no mitigating action were taken, because those people are farther from the sites, they will receive less exposure than people who spend much of each day on-site.

To provide risk managers with the information necessary to make an appropriate potential cleanup decision, risk estimates were calculated for both residential and industrial land-use scenarios. The current proposed reuse of Site 16 is recreational (park). Residential risk is considered to provide a conservative upper-bound estimate of the risk to a park worker or visitor.

Table 7-1
COPCs Evaluated in the Risk Assessment
for Site 16

Analyte	Groundwater	SHALLOW SOIL (0–10 feet bgs) Units 1 and 2	SHALLOW SOIL (0–10 feet bgs) Unit 3	SURFACE SOIL (0–2 feet bgs) Units 1 and 2	SURFACE SOIL (0–2 feet bgs) Unit 3
Volatile Organic Compounds					
1,1,1-Trichloroethane		X			
1,1,2,2-Tetrachloroethane		X			
1,1,2-Trichloro-1,2,2-trifluoroethane	X				
1,1,2-Trichloroethane		X			
1,1-Dichloroethane		X			
1,1-Dichloroethene		X			
1,2-Dichlorobenzene		X		X	
1,2-Dichloropropane		X			
1,3-Dichlorobenzene		X		X	
1,4-Dichlorobenzene		X			
2-Butanone		X	X	X	X
2-Hexanone			X		X
2-Methylnaphthalene		X		X	
Acetone		X		X	
Benzene		X		X	
Bromodichloromethane		X			
Bromoform		X			
Bromomethane		X		X	
Carbon tetrachloride		X	X	X	X
Chlorobenzene		X			
Chlorodibromomethane		X			
Chloroethane		X			
Chloroform		X		X	
Chloromethane		X			
cis-1,2-dichloroethene		X			
cis-1,3-dichloropropene		X			
Dibenzofuran		X			
Ethylbenzene		X		X	
Methylene chloride		X		X	
Naphthalene		X		X	
Phenanthrene		X		X	
Styrene		X			
Tetrachloroethene		X			

(table continues)

Table 7-1 (continued)

Analyte	Groundwater	SHALLOW SOIL (0–10 feet bgs) Units 1 and 2	SHALLOW SOIL (0–10 feet bgs) Unit 3	SURFACE SOIL (0–2 feet bgs) Units 1 and 2	SURFACE SOIL (0–2 feet bgs) Unit 3
Toluene		X	X	X	X
trans-1,2-dichloroethene		X			
trans-1,3-dichloropropene		X			
Trichloroethene	X	X			
Trichlorofluoromethane		X			
Vinyl chloride		X			
m- and p-xylenes		X			
o-xylene		X			
Xylenes (total)		X		X	
Semivolatile Organic Compounds					
Acenaphthene		X			
Acenaphthylene		X		X	
Benz(a)Anthracene		X		X	
Benzo(a)pyrene		X	X	X	X
Benzo(b)fluoranthene		X	X	X	X
Benzo(g,h,i)perylene		X	X	X	X
Benzo(k)fluoranthene		X		X	
bis(2-ethylhexyl)phthalate		X		X	
Chrysene		X		X	
Dibenz(a,h)anthracene		X	X	X	X
Fluoranthene		X		X	
Fluorene		X		X	
Indeno(1,2,3-c,d)pyrene		X	X	X	X
Pyrene		X		X	
Metals					
Aluminum			X		X
Arsenic			X		X
Barium		X	X		X
Beryllium			X		
Chromium			X		
Cobalt			X		X
Copper		X	X		X
Lead			X	X	X
Manganese			X		X
Nickel			X		X
Selenium			X		

(table continues)

Table 7-1 (continued)

		SHALLOW SOIL (0–10 feet bgs)		SURFACE SOIL (0–2 feet bgs)	
Analyte	Groundwater	Units 1 and 2	Unit 3	Units 1 and 2	Unit 3
Silver		X		X	
Thallium		X			
Vanadium			X		X
Zinc		X	X	X	X

Acronyms/Abbreviations:
bgs – below ground surface
COPC – chemical of potential concern

Under the residential scenario, the resident is assumed to be a person who lives in a house on-site from birth to age 30. (Thirty years is the 90th percentile of time that people in the United States live at one address [U.S. EPA 1989].) It is further assumed that the person never leaves the property except when on vacation, which occurs once a year for 2 weeks, and that, beginning at age 7, the person spends 2 days a week outdoors and, thus, handles soil. COPCs in groundwater and in soil from 0 foot to 10 feet bgs are treated as available to the resident, because soil could be excavated from 0 foot to 10 feet bgs for basement and swimming pool construction, and some of the soil from the subsurface may be left on the surface.

Under the industrial scenario, the worker is assumed to be present at the site 8 hours a day, 5 days a week, and 50 weeks a year for 25 years. COPCs in soil to 2 feet bgs are treated as available to the worker. Groundwater is not assumed to be available.

Vadose zone monitoring will be conducted as part of the post-ROD activities. The monitoring data will be used to evaluate the vapor intrusion pathway (the means by which volatile chemicals in groundwater or soil may enter into buildings and affect indoor air quality) to quantify risk from this pathway at the site.

7.2.2 Exposure Pathways

An exposure pathway is the means by which a contaminant moves through the environment from the source to a receptor. Exposure pathways are identified through an analysis of the distribution of the COPCs in the environment and the physical and chemical properties of the COPCs. For a pathway to be complete, all of the following elements must be present: a contaminant source and mechanism for contaminant release, an environmental transport medium, an exposure point, and an exposure route. Exposure pathways for Site 16 are illustrated on Figure 7-1.

Children and adult residents, as well as office/industrial workers, at areas of potential concern could be exposed to COPCs in the soil by:

- ingestion of impacted soil,

- dermal contact with impacted soil, and
- inhalation of vapors and particulates that have been released from impacted soil.

Children and adults living at Site 16 are assumed to obtain water for domestic use from a private well screened in the shallow aquifer. This assumption is conservative because:

- if a private well were constructed at Site 16, it would probably be screened in a deeper interval of the principal aquifer, which supplies better-quality water than the shallow interval of the principal aquifer that has been contaminated from site activities; and
- current reuse plans indicate the likely reuse of Site 16 as recreational (park); therefore, if the current plans are implemented, a residence would not be built at Site 16.

Exposure to COPCs in the groundwater were evaluated via the following pathways:

- ingestion of groundwater,
- dermal contact with groundwater, and
- inhalation of volatiles from groundwater during household water use.

7.2.3 Exposure-Point Concentration

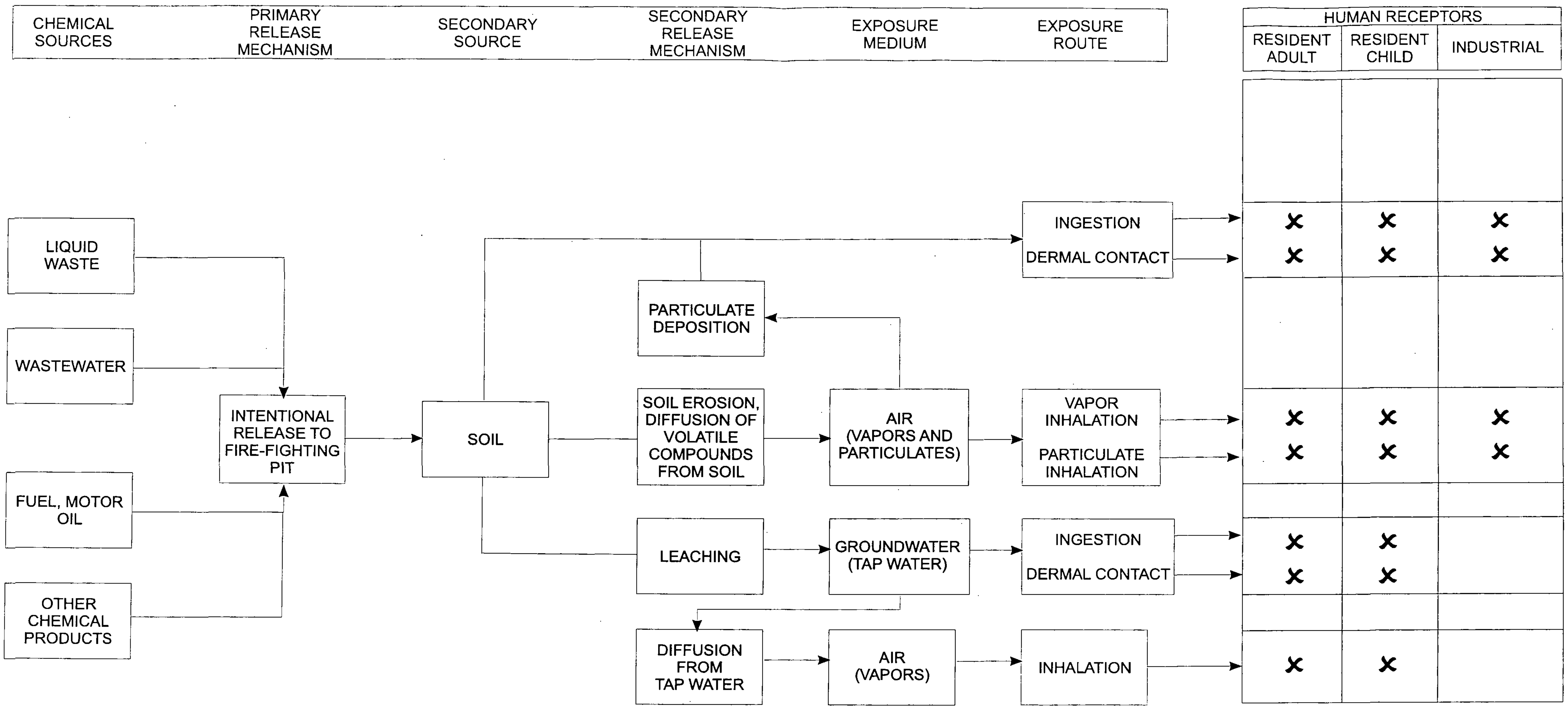
An exposure-point concentration (EPC) is the concentration of a chemical in the contaminated medium (e.g., soil) at the point of contact with a receptor (e.g., resident). Exposure conditions used in the estimation of risk were chosen to represent what is known as "reasonable maximum exposure." Use of these exposure conditions tends to overestimate risk. This effort to overestimate risk is deliberate; it provides risk managers a margin of safety when they make cleanup decisions.

Under reasonable maximum exposure, U.S. EPA specifies using the 95 percent upper confidence limit (UCL) of the average measured chemical concentrations. In calculating the 95 percent UCLs for Site 16, the data were tested for normality or lognormality. Sets of data that failed these tests were analyzed using a nonparametric approach. The maximum concentration, rather than the 95 percent UCL, was used as the EPC in either of the following circumstances.

- The 95 percent UCL of a chemical exceeded its highest measured concentration.
- Fewer than four concentrations were above the limits of detection.

For the resident child and adult (residential scenario), soil concentrations (0 foot to 10 feet bgs) were used to calculate EPCs. For the industrial worker (industrial scenario), surface soil concentrations (0 foot to 2 feet bgs) were used to calculate EPCs. For the groundwater medium, maximum concentrations reported at approximately 170 feet bgs were used as EPCs.

EPCs for each unit and depth interval at Site 16 are in Appendix I of the Phase II RI Report for OU-3A (BNI 1997).



Record of Decision

Figure 7-1

Human Health Exposure Routes and Receptors

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 10/15/02
File No: 045C9873
Job No: 23818-045
Rev No: B

7.2.4 Dose Rate

Dose rate is the amount of chemical to which a receptor is exposed per unit body weight and time. Dose rates were estimated by integrating intake variables, such as ingestion rate, body weight, and exposure duration, with the contaminant concentration. The combination of all intake variables results in an estimate of exposure for each pathway.

The general equation for calculating the dose is:

$$D = (C \times CR \times EF \times ED)/(BW \times AT)$$

where

D = daily dose averaged over the exposure period (mg/kg per day)
C = chemical concentration in the exposure medium (mg/kg)
CR = contact rate with the exposure medium (kilograms per day)
EF = exposure frequency (days per year)
ED = exposure duration (year)
BW = body weight of the exposed individual (kilograms)
AT = averaging time (day)

The exposure assumptions for adults and children exposed to soil and groundwater at Site 16 include the following standard U.S. EPA default assumptions.

- One hundred milligrams a day was assumed for a 70-kilogram adult and 200 milligrams a day for a 15-kilogram child (age 1 to 6 years), 350 days a year.
- For dermal exposure, 25 percent of the resident's skin is in contact with soil for 100 days a year.
- Inhalation of soil particulates and gases is assumed to occur 24 hours a day, 350 days a year.
- Two liters of water a day was assumed to be ingested by a 70-kilogram adult and 1 liter a day was ingested by a 15-kilogram child (age 1 to 6 years).
- For groundwater dermal exposure during showering, whole-body exposure (7,000 square centimeters for children and 19,000 square centimeters for adults) was assumed to occur for 0.25 hours a day, 350 days a year.
- Inhalation of groundwater volatiles during household water use was assumed to occur for 24 hours a day, 350 days a year.
- Adult exposure is assumed for a total of 30 years, 6 years as a child and 24 years as an adult. (Child exposure was assumed to be 6 years.)

The exposure assumptions for the industrial worker are as follows.

- A soil ingestion rate of 50 milligrams a day was assumed for occupational exposures.
- Work is performed 8 hours a day, 250 days a year.

- For dermal exposure, more than 25 percent of the worker's skin is in contact with soil.
- Worker exposure is assumed for a total of 25 years.

7.3 TOXICITY ASSESSMENT

The toxicity assessment identifies toxicity criteria (values) for each of the chemicals chosen for inclusion in the risk assessment and the kinds of effects each of the chemicals can produce. Toxicological chemical effects fall into two categories: those that could potentially cause cancer (carcinogens) and those that cause other types of health effects (e.g., liver damage [noncarcinogens]). Each of the toxicological chemical effects is described by an assigned toxicity factor. These factors are numbers that indicate the toxicity of the chemicals. The toxicity factor for carcinogenic effects is called a cancer slope factor (CSF), and the toxicity factor for noncarcinogenic effects is called a reference dose (RfD).

CSFs are developed by U.S. EPA using a mathematical model that applies data from the results of human epidemiological studies or chronic animal bioassays to predict potential increases of cancer in humans. The use of animal data to predict cancer in humans represents an uncertainty in risk assessment. To account for the uncertainty in CSF calculations, U.S. EPA raises the CSF using upper-bound confidence intervals as a safety factor. The upper-bound confidence interval indicates that there is a 95 percent probability that the actual risk will be less than that predicted by the model.

Each RfD is associated with a specific health effect (e.g., central nervous system damage), also referred to as a "toxicity endpoint." The current scientific view assumes that, for noncarginogenic effects, there is a concentration below which there is little potential for adverse health effects over the exposure period. That concentration is referred to as the "threshold concentration." RfDs are derived from either human (occupational exposure) or animal studies and are adjusted using uncertainty factors. The RfD is calculated from the highest chronic (long-term) exposure level that did not cause adverse effects in the population (human or laboratory animal) studied. A safety factor is applied to this level to allow for any uncertainty, such as when data are used on animals to predict effects on humans. These factors range up to 10,000 based on the confidence level associated with the data. The resulting RfD, in units of body weight per day, is used to characterize the risk.

7.4 RISK CHARACTERIZATION

The final step in the risk assessment is the characterization of risk in which the exposure and toxicity information is integrated to evaluate the potential health risks. Cancer and noncancer risk are quantified separately.

7.4.1 Cancer Risk

The equation specified in the U.S. EPA Risk Assessment Guidance for Superfund (U.S. EPA 1989) for estimating cancer risk is:

cancer risk = CSF × estimated dose rate

Cancer risk is an upper-bound estimate of individual excess probability of increased cancer incidence resulting from exposure to a potential carcinogen. The cancer risks presented by different carcinogens are added across all of the exposure pathways and intake routes to obtain an estimate of overall risk.

A cancer risk probability of 1×10^{-6} means that the estimated potential increase in an individual normal or baseline cancer risk is no greater than 1 in 1 million for a lifetime of exposure, and it may be considerably less. Risks of 10^{-6} or less are considered allowable by U.S. EPA. Risks between 10^{-6} and 10^{-4} are considered generally allowable and require a risk management decision as to whether remedial action is required. Risks greater than 10^{-4} are considered unacceptable.

7.4.2 Noncancer Health Effects

The equation specified for estimating noncancer risk (U.S. EPA) is:

noncancer risk = estimated dose rate/RfD

This ratio of dose to nontoxic dose is called a hazard quotient (HQ). The HQ is a measure of whether the estimated dose of a chemical exceeds the highest toxic dose (i.e., the RfD). The likelihood of effects increases as the ratio increases above 1. A conservative estimate of the hazard associated with exposure to all chemicals by a specific pathway, such as the inhalation pathway, is obtained by summing the HQs of the chemicals associated with the pathway. The sum of HQs is called the "hazard index" (HI).

HIs are not probabilities. An HI is a ratio of an exposure level to a nontoxic level. Because an HI value of 1 indicates that lifetime exposure has limited potential for causing an adverse effect in sensitive populations, values of less than 1 can generally be considered acceptable. Values greater that 1 are usually given closer attention.

7.5 RISK CHARACTERIZATION RESULTS

The following text discusses the resultant risk estimates for industrial and residential receptors at Site 16. These results are summarized in Table 7-2. In addition, the tables and text identify the chemicals of concern (COCs) (risk drivers) accounting for most or all of the total cancer and noncancer risk.

For the carcinogens, two estimates of cancer risk are given for each receptor. The first estimate is based exclusively on U.S. EPA CSFs and the second is based on U.S. EPA CSFs with Cal/EPA CSFs substituted for certain chemicals.

The cancer risk for an adult resident is slightly higher than for a child. Therefore, to simplify the presentation of the results, this section is limited to a discussion of adult cancer risks. Results of the industrial-worker and resident noncancer risk HI and the hazard evaluation of lead are also presented in this section. For a resident receptor, noncancer risk estimates discussed in the text are the higher of the child or the adult estimates.

7.5.1 Units 1 and 2

As shown in Table 7-2, cancer risks at Site 16 Units 1 and 2 fall within U.S. EPA's generally allowable risk range under the industrial and residential scenarios. Risk drivers included vinyl chloride and the PAHs benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. The EPCs and contribution to cancer risks from these chemicals are shown in Table 7-2. As noted in the table, the maximum concentration of most analytes was used to estimate risk at Units 1 and 2.

For additional perspective, a background cancer risk was also estimated for the naturally occurring metals and anthropogenic chemicals (i.e., PAHs and pesticides) identified as soil COPCs. A comparison between on-site and background or reference-level risks provides useful information to risk managers for their selection of remedies. The cancer risk to an industrial worker from dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene exposure at Units 1 and 2 is approximately four times higher than risk at reference levels. However, the risk to an industrial worker from benzo(a)pyrene at Units 1 and 2 was slightly lower than risk at reference levels. The cancer risk to a resident from dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene exposure at Units 1 and 2 is approximately three times higher than risk at reference levels. The risk from benzo(a)pyrene in this area is half the risk at the reference levels.

Based on a statistical comparison of soil concentrations with background concentrations for the Station, lead was not identified as a COPC in shallow soil (0 foot to 10 feet bgs). Therefore, the risk to a resident from exposure to lead in the shallow soil of Units 1 and 2 was not assessed. However, due to slightly higher calculated UCL in the 0 to 2 feet bgs samples, lead was identified as a COPC in surface soil (0 foot to 2 feet bgs). The risk to an industrial worker from exposure to lead in the surface soil (0 foot to 2 feet bgs) is considered negligible on the basis of a comparison of the Cal/EPA industrial PRG for lead (1,000 mg/kg) and the 95 percent UCL for lead (64.5 mg/kg) in the surface soil at the site.

The HI at Units 1 and 2 is less than 1 under both the industrial and residential scenarios, indicating that systemic toxicity is unlikely.

7.5.2 Unit 3

Cancer risks at Unit 3 also fall within U.S. EPA's generally allowable risk range under both the industrial and residential scenarios. Arsenic, beryllium, and dibenz(a,h)anthracene are the principal contributors to the risk. The cancer risk to an industrial worker at Unit 3

Table 7-2
Risk Summary for Industrial and Residential Scenarios at Site 16

Area of Concern	CANCER RISK: INDUSTRIAL SCENARIO (0–2 feet bgs) Risk (U.S. EPA/State)[a]	Risk Drivers (U.S. EPA/State) (percent)	EPC (mg/kg)	CANCER RISK: RESIDENTIAL SCENARIO (0–10 feet bgs) Risk (U.S. EPA/State)[a]	Risk Drivers (U.S. EPA/State) (percent)	EPC (mg/kg or as marked)	NONCANCER RISK: INDUSTRIAL SCENARIO (0–2 feet bgs) Hazard Index	Risk Drivers	EPC (mg/kg)	NONCANCER RISK: RESIDENTIAL SCENARIO (0–10 feet bgs) Hazard Index	Risk Drivers (percent)	EPC (mg/kg or as marked)
Site 16, Units 1 and 2, soil[b]	1.4E-6/ 1.7E-6	dibenz(a,h)anthracene (41/34) benzo(a)pyrene (38/51) indeno(1,2,3-c,d)pyrene (12/10)	0.028[c] 0.026[c] 0.084[c]	1.6E-6/ 1.8E-6	dibenz(a,h)anthracene (51/46) benzo(a)pyrene (19/28) vinyl chloride (9/8)	0.027 0.01 0.00084[c]	0.0068	—[d]	—	0.13	—	—
Site 16, Unit 3, soil[b]	6.7E-6/ 6.9E-6	arsenic (55/54) dibenz(a,h)anthracene (36/35)	3.5 0.12[c]	1.9E-5/ 2.0E-5	arsenic (68/65) dibenz(a,h)anthracene (19/19) beryllium (11/11)	3.9 0.12[c] 0.28	0.11	—	—	1.3	manganese (50)	290
Site 16, groundwater	NA	NA	NA	8.0E-5	TCE (99)	0.13[c] mg/L	NA	NA	NA	8.4	TCE (99)	0.13[c] mg/L

Source:
BNI 1997

Notes:
[a] risk is listed once when U.S. EPA-derived risks equal state-derived risks
[b] area of concern recommended for no further action
[c] maximum concentration used as the EPC
[d] dash indicates not applicable

Acronyms/Abbreviations:
bgs – below ground surface
EPC – exposure-point concentration
mg/kg – milligrams per kilogram
mg/L – milligrams per liter
NA – not assessed
TCE – trichloroethene
U.S. EPA – United States Environmental Protection Agency

from arsenic and dibenz(a,h)anthracene is approximately 1.8 and 15 times higher, respectively, than at background and reference levels. The cancer risk from exposure to beryllium at Unit 3 was slightly less than the risk at background.

The risk from lead is considered negligible on the basis of two comparisons: 1) a comparison of the Cal/EPA industrial PRG for lead (1,000 mg/kg) with the 95 percent UCL for lead (53.8 mg/kg) in the surface soil of Unit 3, and 2) a comparison of the Cal/EPA residential PRG for lead (130 mg/kg) with the 95 percent UCL for lead (32 mg/kg) in the shallow soil of Unit 3.

The HI at Unit 3 is less than 1 under the industrial scenario, indicating that systemic toxicity is unlikely. The HI for a hypothetical resident child exposed to shallow soils at Unit 3 is 1.3. Incidental ingestion was the dominant noncancer risk pathway. The majority of the HI is due to manganese. The HI for manganese at Unit 3 is approximately 1.4 times its HI at background.

7.5.3 Groundwater

Groundwater presents the highest cancer risk for the hypothetical resident adult of any area of potential concern at Site 16. The excess lifetime cancer risk from groundwater was estimated at 8.0×10^{-5} using both U.S. EPA and Cal/EPA toxicity criteria. Vapor inhalation was the dominant risk pathway. TCE is the principal contributor to the risk. The HI for a hypothetical resident child exposed to groundwater is 8.4. Vapor inhalation was the dominant noncancer risk pathway. The majority of the HI is also due to TCE.

The risk assessment for groundwater at Site 16 was based on groundwater data collected during the Phase II RI in 1996. The EPCs used in the risk calculations were the maximum concentrations reported in groundwater at Site 16 and, therefore, were considered conservative estimates. Although a great amount of groundwater data has been collected subsequent to the RI at Site 16, a comparison of the EPCs with recently collected groundwater data indicates that the EPCs still represent conservative estimates. Therefore, calculated risks for a hypothetical resident still overestimate exposures and risks from groundwater at Site 16.

7.6 BASIS FOR RISK MANAGEMENT DECISION

After a thorough review of the results of the HHRA, the DON and regulatory members of the BCT evaluated the risks and made a risk management decision that risks due to shallow soil were acceptable, but risks due to groundwater were not acceptable. The basis for this decision follows.

As shown in Table 7-2, all cancer risks at Site 16 were estimated within the generally allowable range of 10^{-6} to 10^{-4}. Both U.S. EPA and DTSC have indicated in their comments on past documents that they interpret the generally allowable (i.e., 10^{-6} to 10^{-4}) risk range stated in the NCP as the risk range that should be carefully evaluated for remediation, depending on the frequency and duration of exposure, the population potentially exposed, the weight of evidence of carcinogenicity, and other factors, including feasibility and cost of remediation. Both U.S. EPA and DTSC consider a more appropriate term for the 10^{-6} to 10^{-4} range to be the "risk management range" and that the 10^{-6} risk value should be the point of departure for considering remediation of risks in this range. In accordance with this guidance, risks within the range of 10^{-6} to 10^{-4} were subject to a point-of-departure evaluation using criteria provided in the NCP Preamble (*Federal Register* [Fed. Reg.], Vol. 55, No. 46, page 8717).

According to the NCP Preamble, "Preliminary remediation goals for carcinogens are set at a 10^{-6} excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate factors including, but not limited to: exposure factors, uncertainty factors, and technical factors.

"Included in the exposure factors are: the cumulative effect of multiple contaminants, the potential for human exposure from other pathways at the site, population, sensitivities, potential impacts on environmental receptors, and cross-media impacts of alternatives.

"Factors related to uncertainty may include: the reliability of alternatives, the weight of scientific evidence concerning exposures and individual and cumulative health effects, and the reliability of exposure data.

"Technical factors may include: detection/quantification limits for contaminants, technical limitations to remediation, the ability to monitor and control movement of contaminants, and background levels of contaminants. The final selection of the appropriate risk level is made when the remedy is selected based on the balancing of criteria. . . ."

Of the factors enumerated in the NCP, the primary factors that the DON considered in their determination that no further action was appropriate for shallow soil (0 foot to 10 feet bgs) at Site 16 were the background levels of contaminants, the ability to monitor and control movements of contaminants, and the reliability of exposure data. These factors are discussed in the following sections along with future uses of the sites and distribution of contaminants.

7.6.1 Background Level of Contaminants

The largest contributors to cancer risks at Site 16 were arsenic and PAHs. The largest contributors to noncancer risks were manganese and TCE.

To evaluate the risk contributions from arsenic, the DON compared the concentrations of arsenic with concentrations present in background samples. A background study of metals in soil at Former MCAS El Toro was performed in 1996 (BNI 1996a). Based on this study, which included 43 samples with arsenic concentrations from 0.29 to 8.5 mg/kg, the background concentration of arsenic was determined to be 6.86 mg/kg. This value represents the 95th quantile, or percentile of the mean population value. The RI data for arsenic in soil at Site 16 are summarized in Tables 4-3, 4-5, 4-6, 4-8, 4-9, and 4-10 of the Phase II RI Report. These data indicate that 100 percent of the arsenic analytical results are less than the background concentrations for Former MCAS El Toro.

Based on results of this comparison, it was concluded that the concentrations of arsenic present at Site 16 reflect natural, background conditions.

Under industrial conditions, the noncancer risk is less than 1. For residential land use, the noncancer risk equals or exceeds the threshold of 1 for Site 16 Unit 3 (HI equals 1.3). This exceedance is mainly from manganese (50 percent). The background level for manganese was determined to be 291 mg/kg. This level was based on 43 samples with manganese concentrations ranging from nondetect to 574 mg/kg (BNI 1996a). The RI data for manganese in soil at Site 16 showed that approximately 81 percent of the manganese analytical results are less than the background concentrations. The highest concentration of manganese, 507 mg/kg, was lower than the highest concentration measured in the background population sample. In addition, from a risk perspective, the HI for manganese at Unit 3 was only 1.4 times its HI at background. This level indicates that the concentration of manganese is not significantly different from background at the site. Finally, there is no known historical site-related activity that involved the use of manganese. Therefore, noncancer risk from soil is not considered significant.

The cumulative HI of 8.4 for groundwater at Site 16 is due primarily to TCE (99 percent). TCE does not occur naturally and, therefore, has no background value. Further action was recommended for groundwater.

7.6.2 Ability to Monitor and Control Movement of Contaminants

Another factor considered by the DON in making the decision for no further action for shallow soil at Site 16 is the low mobility of PAHs. As discussed in the fate and transport evaluation in Section 5 of the OU-3A RI Report (BNI 1997), as a chemical group, PAHs have low water solubility and high affinity for sorption to organic matter. These are characteristics that limit the potential for leaching through soil as a transport process and cause the chemicals to be relatively immobile. The relative immobility of PAHs was verified through site-specific sampling that showed that concentrations of PAHs reported in Unit 3, the drainage swale, were orders of magnitude lower than concentrations reported in shallow soil in the area of the main burn pit, and that only the most mobile and relatively persistent of the site-related chemicals (primarily TCE) appear to have reached groundwater (see Sections 5.3.2 and 5.3.3 for further discussion).

7.6.3 Reliability of Exposure Data

The DON also considered the reliability of exposure data in making the decision for no further action for shallow soil at Site 16. As discussed in the fate and transport evaluation for Site 16 (Section 5 of the FFS Report), biodegradation is the most important transformation process affecting the persistence of PAHs in shallow soil (BNI 2002b). Another potentially important transformation process, photolysis, is limited to areas where surface soils are exposed to sunlight.

The chemical concentrations used in the risk assessment were assumed to remain constant for the entire exposure duration. However, it is highly unlikely that the organic concentrations will remain constant, particularly in soil. Benzo(a)pyrene, dibenz(a,h)anthracene, and indeno (1,2,3-c,d)pyrene, the risk drivers, are biodegradable. Under aerobic conditions, the half-lives of these PAHs have been estimated to be 1.45, 2.58, and 2 years, respectively, with 0.16, 1, and 1.64 years possible under ideal conditions (Howard et al. 1991). This means that it is very likely that the risks due to PAHs are overstated.

Manganese was the largest contributor to noncancer risk. However, as discussed in the FFS Report for Site 16, the contribution of manganese is overstated in the risk evaluations for Former MCAS El Toro because, for inhalation exposures, the RfD values used represent only the adult receptor. The inhalation RfDs were estimated from inhalation reference concentrations by integrating the adult body weight and inhalation rate. The resultant adult RfD is also used to estimate the noncancer risk for a resident child. Use of an adult RfD overestimates the resultant hazard to a child; the noncancer risk would be significantly lower if a child-derived RfD were used.

Another area of uncertainty in the exposure assessment is the prediction of human activities that lead to contact with environmental media and exposure to chemicals. The residential risk assessment assumes that an adult is exposed to chemicals present at the site 24 hours a day, 350 days a year, for 30 years. In reality, exposure times are likely to be much less, especially because the current anticipated reuse of Site 16 is not residential.

Finally, data evaluation involves using statistics to summarize the data, comparing summary data to background concentrations, and selecting COCs. A chemical was assumed to be present at one-half the detection limit in samples where no chemical was actually identified. Thus, no zero values were used in the calculation of the 95 percent UCLs. In addition, maximum concentrations, rather than 95 percent UCLs, were used as the EPCs under certain conditions (see Section 7.5.3). The assumption of long-term contact with the maximum concentration is conservative, and the use of the maximum concentration in the risk assessment results in overestimations of exposures and risks.

7.6.4 Future Use of Site 16

The NCP allows future use of a site to be considered during a risk assessment. The future use of Site 16 is recreational (park). Had the risk assessment been performed for a recreational use, risk at every unit would have been lower than the residential risk values discussed above because the length of exposure would have been much less than 24 hours a day for 30 years.

7.6.5 Distribution of Contaminants

The final factor considered by the DON was whether the distribution of contaminants within each unit at these sites indicated that the concentration of contaminants at one or more sampling locations was significantly elevated over the remaining unit concentrations (possibly representing a hot spot). The DON and the regulatory agency members of the BCT examined the data collected at the sites during the RI and did not identify areas requiring further evaluation as hot spots.

7.7 EVALUATION OF RISK AFTER PILOT STUDY

The HHRA performed during the RI was reviewed on the basis of the MPE pilot study results but was not revised for the following reasons.

- Residential and industrial risks were based on COPCs reported in the top 10 and 2 feet bgs, respectively. MPE was focused on the deeper vadose zone and would be expected to have minimal impact on contamination in shallow soil.
- Risk drivers in shallow soil included PAHs and metals. These chemicals would not be impacted by MPE.
- TCE was the primary risk driver in groundwater. However, only a minimal amount of TCE was removed from groundwater during the pilot study and the concentration of TCE was essentially unchanged. Therefore, the groundwater risk would be expected to be the same before and after the pilot study.

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Section 8
DESCRIPTION OF ALTERNATIVES

This section summarizes the RAOs and describes the remedial alternatives selected for detailed analysis in the FFS for Site 16. These alternatives are based on the Phase I and Phase II RIs, the MPE pilot test, the baseline HHRA, and a review of all applicable or relevant and appropriate requirements (ARARs).

8.1 REMEDIAL ACTION OBJECTIVES AND CLEANUP STANDARDS

The following RAOs were developed for vadose zone soil (below 10 feet bgs to groundwater) and groundwater at Site 16.

- Monitor concentrations of VOCs in soil vapor in the vadose zone at Site 16 to confirm concentrations are not increasing with time.
- Consistent with applicable U.S. EPA, California State Water Resources Control Board, and RWQCB policies and regulations, restore potential beneficial uses of the shallow aquifer underlying Site 16 to the extent practicable, while preventing or minimizing VOC migration beyond current boundaries at concentrations exceeding site cleanup levels.
- Protect human health by preventing use of VOC-contaminated shallow groundwater until site cleanup goals are achieved.

The remedial action objectives for Site 16 are intended primarily to assure the continued beneficial use of groundwater from the principal aquifer. Groundwater from this aquifer (Irvine Forebay I) is currently used for agriculture but is also designated by RWQCB as a potential source of drinking water.

Table 8-1 presents the numerical cleanup standard for TCE, which is the only COC in groundwater. This cleanup standard is based on the U.S. EPA MCL, which is the controlling ARAR contaminant level.

Table 8-1
Criteria and Standards for Chemicals of Concern in Groundwater for Site 16
(units reported in micrograms per liter)

Analyte	Maximum Contaminant Level (40 C.F.R. § 141.61[a])	California Maximum Contaminant Level (Cal. Code Regs. tit. 22, § 64444[a])	Controlling ARAR Contaminant Level	Maximum Concentration Reported During RI	Maximum Concentration Reported in March 2002
Trichloroethene	5	5	5 (federal)	130	190

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
RI – remedial investigation
§ – section
tit. – title

8.2 REMEDIAL ALTERNATIVES

Two remedial alternatives in addition to the required no action alternative have been developed to address VOCs in soil and groundwater at Site 16. One alternative includes a combination of monitored natural attenuation (MNA), institutional controls, vadose zone monitoring, and site grading; the other alternative includes groundwater extraction, *ex situ* treatment of VOC-contaminated groundwater, site grading, institutional controls, and vadose zone and groundwater monitoring. The conceptual designs developed for the two alternatives are based on site-specific data collected during the RI and FS, data collected during the MPE pilot study, and groundwater modeling simulations performed for Site 16 as part of the FFS. Petroleum hydrocarbons were reported during previous sampling at Site 16. Petroleum hydrocarbons in soil at Site 16 will be addressed under the Former MCAS El Toro Petroleum Corrective Action Program.

The development of Site 16 remedial alternatives followed the requirements identified in CERCLA, as amended by SARA, 42 *United States Code* (U.S.C.) Section (§) 9601 et seq., and the NCP. The development of remedial alternatives was also guided by prior U.S. EPA experience at VOC-contaminated sites (U.S. EPA 1993a,b, 1996, 1997).

The sections that follow provide general descriptions of the remedial alternatives, including the conceptual designs used to evaluate the alternatives. The final number and locations of monitoring wells, frequency of monitoring, and types of analyses will be determined during the engineering design phase. In addition, remedy refinements (e.g., adjustments to the number of wells, changes in well locations) will be made as necessary during the life of the remedy.

8.2.1 Alternative 1 – No Action

Alternative 1, the no action alternative, is required by the NCP (40 *Code of Federal Regulations* (C.F.R.) §§ 300–430[e][6]) to provide a baseline condition if no remedial action is taken. Under this alternative, no remediation measures, monitoring, or land-use controls would be implemented at Site 16.

Under Alternative 1, conditions at Site 16 would remain as described in Section 5. As recommended in the draft FS Report, the MPE pilot study was conducted to evaluate the effectiveness of the treatment alternatives presented in the draft FS Report. The MPE pilot study removed approximately 127 pounds of VOCs from soil beneath Site 16. Based on currently available information, the removal of these VOCs from soil beneath Site 16 has effectively reduced VOC concentrations to levels that are unlikely to impact groundwater above drinking water standards. A summary of the MPE pilot study results is presented in Section 5.2.3.8. Although the VOC mass in the unsaturated zone beneath the main pit (former source area) has been reduced, a plume of TCE-contaminated groundwater remains beneath Site 16.

To predict the future migration of the TCE groundwater plume beneath Site 16, groundwater modeling was performed under the no action alternative based on the current site conditions. The results of this modeling conservatively indicate that the plume may migrate up to 1,300 feet downgradient from its current position but would decrease in extent thereafter. In addition, the maximum TCE concentration is predicted to decline to less than the 5 μg/L MCL after 19 years.

8.2.2 Alternative 2 – Monitored Natural Attenuation With Institutional Controls

Alternative 2 would rely on MNA to reduce concentrations of VOCs in groundwater. MNA would be coupled with institutional controls to prevent potential use of VOC-contaminated groundwater until cleanup goals are achieved. In addition, this alternative also includes vadose zone monitoring (to confirm VOC concentrations in the vadose zone are not increasing) and site grading activities (to reduce potential infiltration in the main pit area).

8.2.2.1 MONITORED NATURAL ATTENUATION

The principal component of Alternative 2 is MNA. MNA was considered viable for Site 16 because sampling performed during the RI indicated that after 15 to 28 years of potential migration, the TCE groundwater plume originating beneath the main pit (former source area) at Site 16 has only extended about 300 feet downgradient. Furthermore, sampling analytical results indicate that TCE concentrations in groundwater attenuate by a factor of 5 to 10 times (from 390 μg/L to between 37 and 78 μg/L) within a distance of about 200 feet from the main pit and are not reported (concentrations less than 0.5 μg/L) 350 feet farther downgradient. These analytical data, coupled with the considerable difference in hydraulic conditions observed during aquifer tests conducted at extraction wells 16MPE1 (main pit) and 16GE1 (downgradient), suggest that naturally occurring *in situ* physical processes such as dispersion, dilution, and adsorption are passively attenuating the TCE plume downgradient from the source area.

8.2.2.2 INSTITUTIONAL CONTROLS

Institutional controls in the form of land-use restrictions will be used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances and to maintain integrity of the remedial action until remediation is complete and federal and state cleanup levels have been met. Monitoring and inspections will be conducted to assure that the land-use restrictions are being followed.

The following are the land-use control (LUC) objectives to be achieved through land-use restrictions for this site.

- Prohibit the installation of new groundwater wells of any type and prevent the use of VOC-contaminated groundwater without prior review and written approval from DON, DTSC, U.S. EPA, and RWQCB until cleanup objectives have been achieved.
- Prohibit the installation of any well that has the potential to affect plume migration.
- Prohibit the alteration, disturbance, or removal of groundwater monitoring wells and associated equipment (including extraction wells and treatment equipment

should more active remediation be required in the future) without prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB.

- Require maintenance of positive drainage over the main pit area of Site 16 to minimize infiltration into soil at this location.

The DON shall address institutional control implementation and maintenance actions including periodic inspections in the Preliminary and Final Remedial Design reports to be developed and submitted to the FFA signatories for review pursuant to the FFA. The Preliminary and Final Remedial Design reports are primary documents as provided in Section 7.3 of the FFA. The Preliminary and Final Remedial Design reports shall include a LUC remedial design section to describe LUC implementation actions including:

- requirements for CERCLA 5-year remedy review;
- frequency and requirements for periodic monitoring or visual inspections;
- reporting results from monitoring and inspections;
- notification procedures to the regulators for planned property conveyance, corrective action required, and/or response to actions inconsistent with LUCs for the remedy;
- consultation with U.S. EPA, DTSC, RWQCB, and other government agencies regarding wording for land-use restrictions and parties to be provided copies of the deed language once executed;
- identification of responsibilities for DON, U.S. EPA, DTSC, RWQCB, other government agencies, and the new property owner for implementation, monitoring, reporting, and enforcement of LUCs;
- provision of a list of LUCs with the expected duration; and
- maps identifying where LUCs are to be implemented.

The DON shall be responsible for implementing, inspecting, reporting, and enforcing the LUC objectives described in this ROD in accordance with the approved Remedial Design reports. Although the DON may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, the DON shall retain ultimate responsibility for remedy integrity. Should any of the LUC objectives fail, the DON shall ensure that appropriate actions are taken to reestablish protectiveness of the remedy and may initiate legal action to either compel action by a third party(ies) and/or recover the Navy's costs for mitigating any discovered LUC violation(s). The LUCs shall be maintained until the concentrations of hazardous substances in groundwater have been reduced to levels that allow for unlimited exposure and unrestricted use.

The DON and DTSC shall enter into Environmental Restriction Covenant and Agreement(s) as provided in the "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant models (10 March 2000) prior to transfer of property impacted by remaining groundwater contamination at Site 16. The Environmental Restriction Covenant and Agreement(s) shall conform to the models attached to this Memorandum of

Agreement and incorporate land-use restrictions identified in the Final Remedial Design reports. The Environmental Restriction Covenant and Agreement(s) shall address the real property containing the Site 16 shallow groundwater plume and associated buffer zone.

The area requiring institutional controls at Site 16 is shown on Figure 8-1. The groundwater modeling simulation performed for Alternative 2 (natural groundwater conditions at Site 16 [i.e., no groundwater pumping]) predicts the leading edge of the TCE plume (5 µg/L TCE contour) may migrate up to 1,300 feet downgradient of the main pit and then will decrease significantly in size and concentration. After 19 years, the maximum concentration is predicted to be below the MCL for TCE (5 µg/L). Institutional controls that will be implemented for the preferred remedy will cover the maximum predicted extent of the TCE groundwater plume as indicated by the groundwater model with an additional buffer zone of approximately 300 feet. The 300-foot buffer zone is designed to prevent construction of groundwater extraction wells that could cause the plume to migrate in the direction of the wells or otherwise interfere with implementation of the remedy. The size of the buffer zone is based on the maximum radius of influence of well 16GE1.

8.2.2.3 GROUNDWATER MONITORING

Implementation of the MNA remedy will be developed during the remedial design phase and described in the Remedial Design reports. A conceptual design was developed during the FS to evaluate alternatives. Long-term groundwater monitoring would be conducted to document that existing *in situ* physical processes are continuing to attenuate the TCE-contaminated groundwater plume approximately 160 feet bgs at Site 16.

The conceptual design for the monitoring well network for this alternative assumes the use of seven wells as illustrated on Figure 8-2. The conceptual design includes an upgradient and downgradient well. The downgradient well will serve as the guard well to document that the leading edge of the plume (TCE 5 µg/L concentration contour) is not migrating beyond that location.

The effectiveness of this alternative and the required duration of MNA at Site 16 were estimated from groundwater modeling results that conservatively predict that the TCE plume may migrate up to 1,300 feet downgradient from its current position but that the maximum TCE concentration would decrease to less than the 5 µg/L MCL after 19 years. Because the modeling results suggest the TCE plume may migrate downgradient beyond the location of the current guard well (16MW2), this alternative includes provisions for installing an additional well farther downgradient should conditions defined by the modeling actually occur.

The conceptual design for Alternative 2 assumed groundwater samples would be analyzed for halogenated and aromatic VOCs, SVOCs, TPH, chloride, iron (II/III), methane, ethane, and ethene, nitrate/nitrite, sulfate/sulfite, and total organic carbon. In addition to these analyses, the conceptual sampling design included field measurements of conductivity, dissolved oxygen, oxidation/reduction potential, turbidity, pH, and temperature. Additional information regarding the assumptions used for groundwater monitoring for Alternative 2 are provided in the final FFS Report for Site 16 (BNI 2002b). The final number and locations of monitoring wells, frequency of monitoring, and types of analyses would be determined during the remedial design phase for this alternative.

Results of the Alternative 2 monitoring activities conducted at Site 16 each year throughout the duration of this remedy would be summarized in an annual groundwater monitoring report.

8.2.2.4 VADOSE ZONE MONITORING

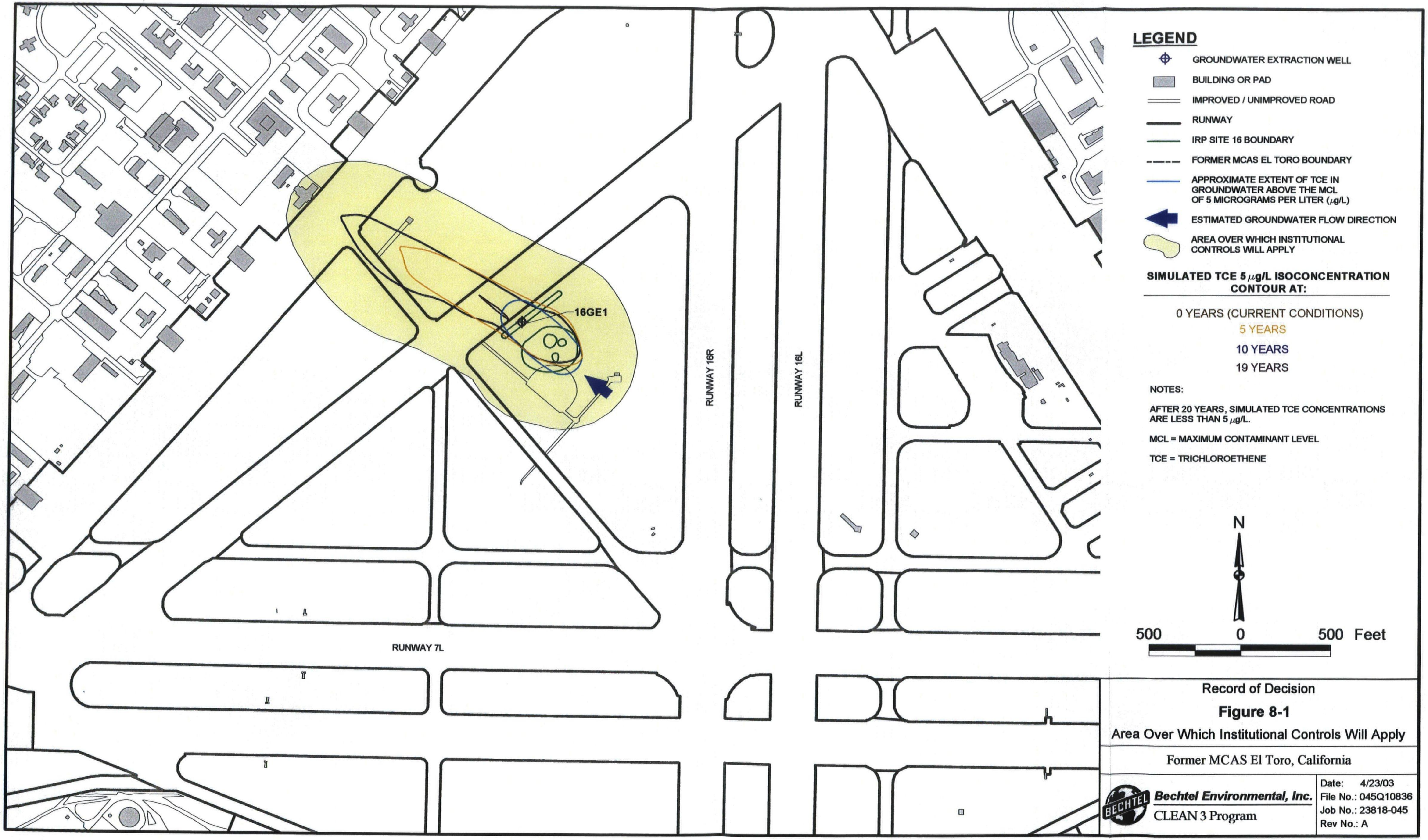
Vadose zone monitoring would be performed to confirm that the TCE soil gas concentrations reported in the vadose zone following the MPE pilot study are not impacting groundwater. As part of the remedial design activities for this alternative, a sampling and analysis plan (SAP) would be prepared. This plan would include the data quality objectives for performing the vadose zone monitoring. The SAP would be prepared in consultation with and receive approval from the BCT prior to initiating vadose zone monitoring activities. The vadose zone monitoring approach is presented on Figure 8-3. This decision flow diagram shows the proposed wells to be sampled, data evaluations, and subsequent decisions that will be made based on the results of the evaluations.

Vadose zone monitoring would be conducted quarterly for 2 years in conjunction with the groundwater sampling. Results of the vadose zone sampling would be reported in the annual groundwater monitoring reports; at the end of 2 years of monitoring, a vadose zone closure report will be prepared if results confirm MPE results and other requirements have been met (i.e., TPH closure has been achieved).

Vadose zone monitoring activities would be performed in consultation with the BCT, including the evaluation of the vadose zone monitoring and the closure procedures to be completed prior to closing the vadose zone.

8.2.2.5 SITE GRADING

Alternative 2 also includes provisions for grading the main pit at Site 16. The main pit, which still exists at the site, is a roughly circular depression approximately 67 feet in diameter and from 2 to 3 feet in depth. To prevent future accumulation of rainfall and subsequent infiltration, the main pit would be filled in with clean soil from an off-site source. The soil to be backfilled will be verified as clean prior to backfilling activities. The end result of the grading would be that the main pit area would be higher topographically than the surrounding grade so that infiltration from rainfall would be greatly reduced and potential surface flow would be redirected around the main pit area. Furthermore, grading would direct rainfall runoff in the main pit area to the northwest (present surface flow direction) toward storm drains located approximately 150 feet away. The area to be graded is less than 1 acre in size.

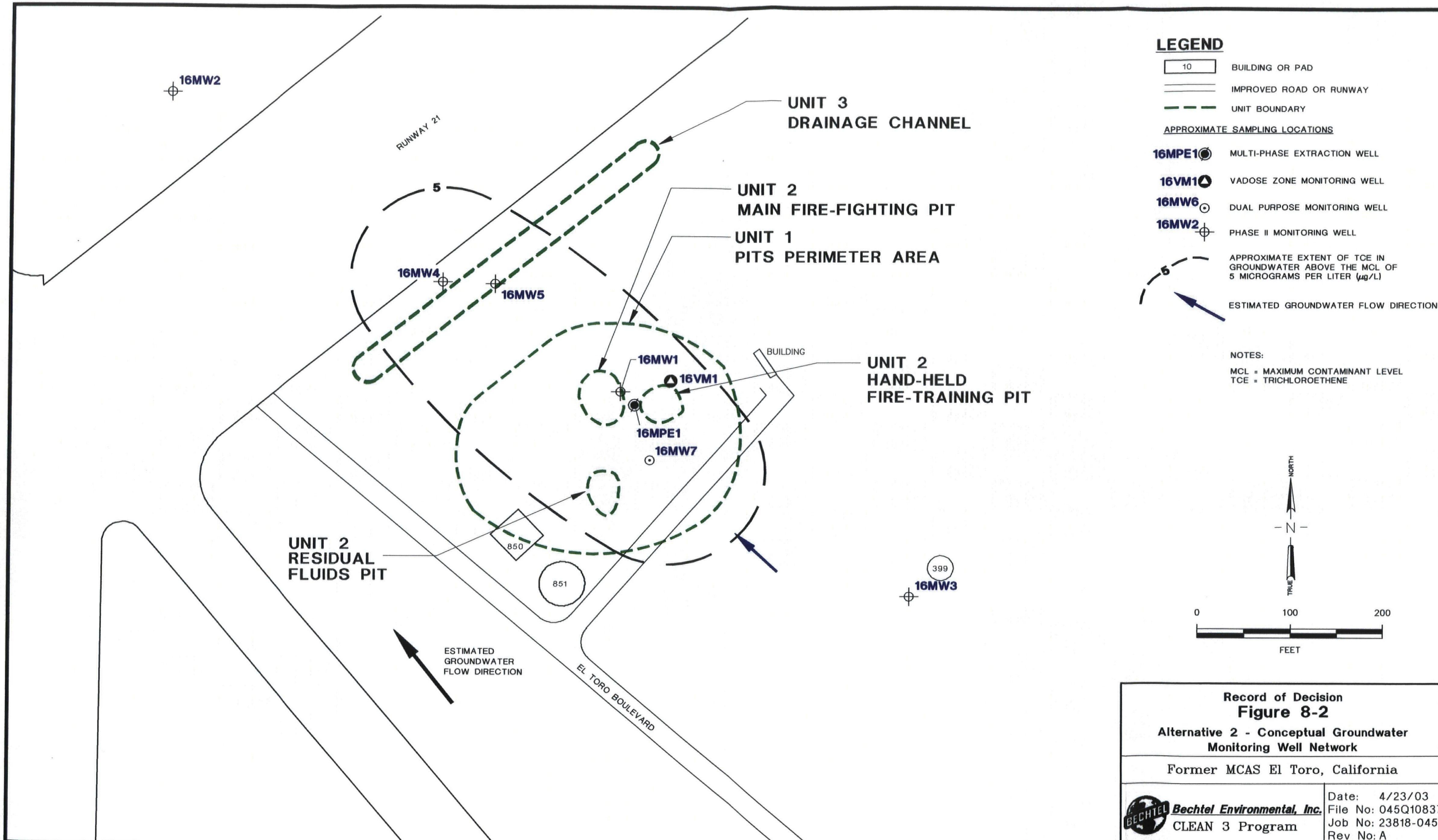


Record of Decision

Figure 8-1

Area Over Which Institutional Controls Will Apply

Former MCAS El Toro, California

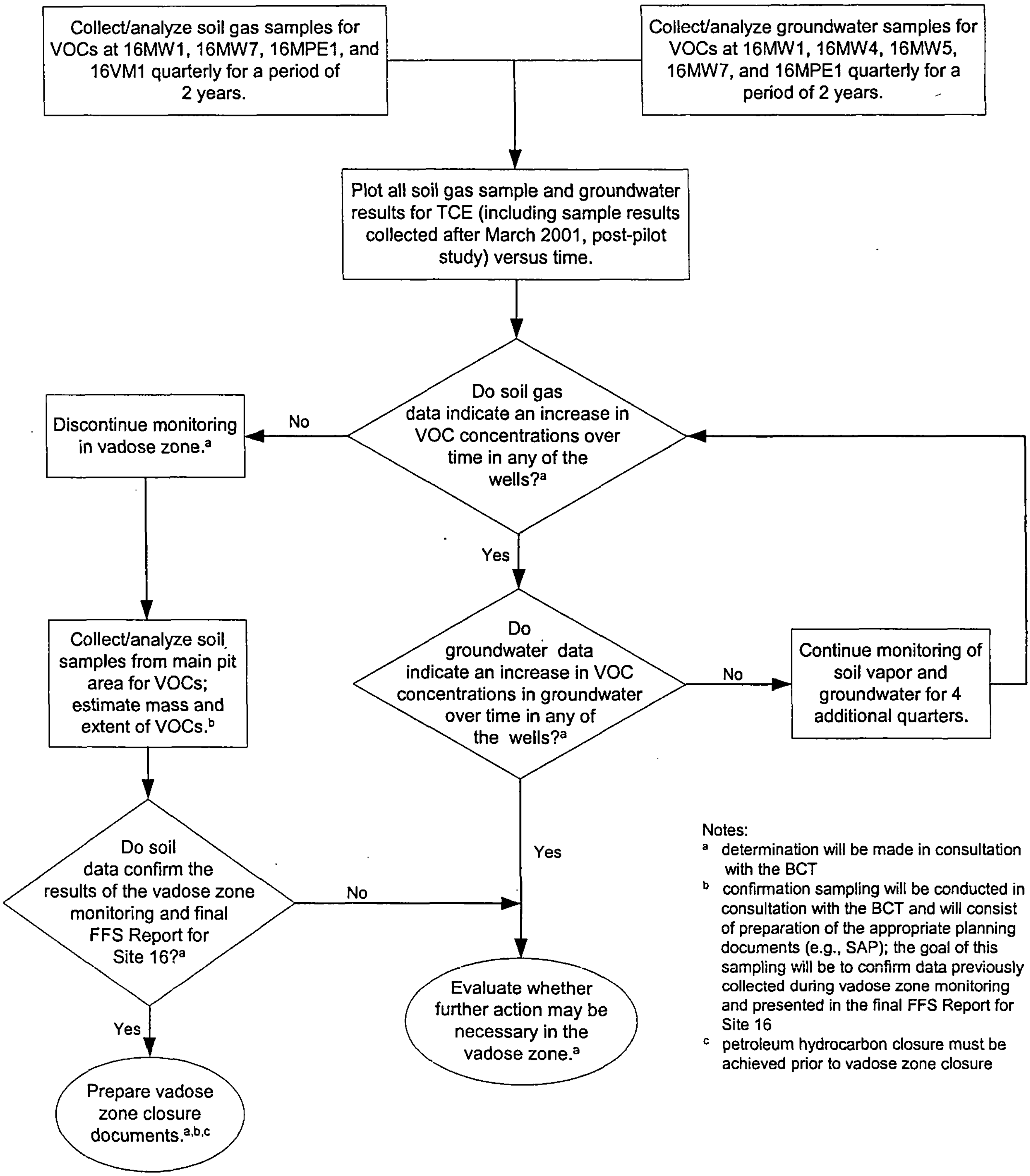


Record of Decision
Figure 8-2
Alternative 2 - Conceptual Groundwater Monitoring Well Network

Former MCAS El Toro, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/23/03
File No: 045Q10837
Job No: 23818-045
Rev No: A



HYPOTHESIS: The mass of TCE in vadose zone soil (10 feet below ground surface to groundwater) has been significantly reduced by MPE pilot study activities and the estimated mass remaining in the soil (represented by the current TCE concentration in soil gas at the groundwater interface) appears unlikely to impact groundwater. Therefore, if the TCE concentration in soil gas does not increase over time, then the remaining TCE in soil does not represent a significant threat to the groundwater, and the vadose zone can be closed.

Figure 8-3
Decision Tree – Post-ROD Vadose Zone Monitoring

8.2.2.6 REMEDIAL DESIGN AND 5-YEAR REVIEW

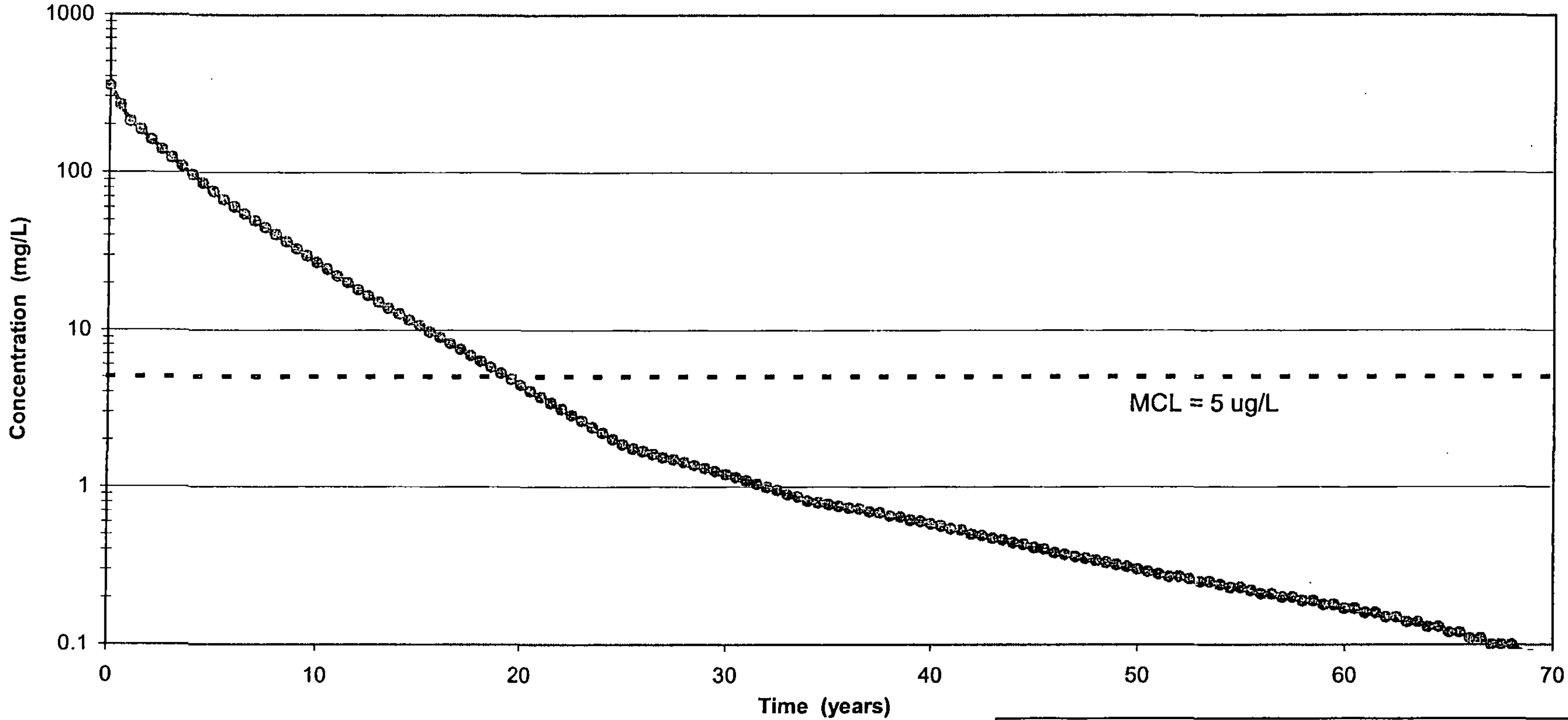
A remedial design will be prepared for the selected remedy for Site 16 to determine the exact specifications of the remedy (e.g., the wells [existing or new] that would be monitored). The Remedial Design reports to be prepared will address long-term monitoring activities, the contingency remedy, the LUC remedial design, and other pertinent information necessary to implement the remedy at Site 16. Once the remedial design is completed, the remedial action will be implemented.

A 5-year review will evaluate the implementation and performance of the remedy. The review will be conducted to determine whether the remedy is or will be protective of human health and the environment in the future. The main issue to be addressed by the 5-year review is whether the remedy is functioning as intended by the decision makers (U.S. EPA, Comprehensive Five-Year Review Guidance, Office of Emergency and Remedial Response (5204G), Directive No. 9355.7-03B-P, June 2001). The 5-year review would include an evaluation of existing data to date against the predicted groundwater modeling outcomes presented in the Site 16 FS. This evaluation would be performed by recalibrating the groundwater model with groundwater data collected during implementation of the remedy. In addition, this evaluation would include a comparison of the TCE groundwater concentration data collected during implementation of the remedy against the maximum TCE concentration predicted by the groundwater model (Figure 8-4).

8.2.3 Alternative 3 – Downgradient Groundwater Extraction and Containment (With Liquid-Phase Granular Activated Carbon [LGAC] Treatment, On-Site Discharge of Treated Water to Storm Drain, and Institutional Controls)

Alternative 3 would use groundwater extraction along with liquid-phase granular activated carbon (LGAC) treatment of the recovered VOC-contaminated groundwater and on-site discharge of the treated water to the storm drain system to contain the downgradient migration of the TCE plume at Site 16. The conceptual design for Site 16 would consist of hydraulic containment of the TCE-contaminated groundwater plume downgradient at Site 16 through sustained pumping of extraction well 16GE1 (Figure 8-5). This location was selected based on the aquifer testing conducted during the MPE pilot study. Within the capture zone thus created, dissolved VOC contaminants moving with the groundwater would be drawn toward the well and extracted, preventing further downgradient migration of the contaminant plume.

The VOC-contaminated groundwater removed at the extraction well would be treated using an on-site LGAC system. The treated groundwater would then be discharged to an on-site storm drain inlet from where it would be conveyed through the existing storm drain system to Bee Canyon Wash. Groundwater monitoring would be conducted to document the progress of the remedial action and to confirm that complete hydraulic containment of the plume had been achieved.



LEGEND:

Predicted TCE Concentration

Maximum Contaminant Level (MCL) for TCE

Record of Decision
Figure 8-4
Predicted Maximum TCE Concentrations with Time for Natural Conditions
Site 16 - Crash Crew Pit No. 2

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CLEAN 3 Program

Date: 10/16/02
File No. fig8-3.xls
Job No. 23818-045

This alternative would also employ institutional controls to prevent potential use of VOC-contaminated groundwater beneath Site 16; prevent damage to the monitoring and extraction wells, associated piping, and groundwater treatment equipment; and maintain positive drainage over the main pit. See Section 8.2.2.2 of this ROD. This alternative also includes vadose zone monitoring and site grading activities. The institutional controls, vadose zone monitoring, and site grading are identical to those for Alternative 2 as described in Sections 8.2.2.2, 8.2.2.4, and 8.2.2.5, respectively.

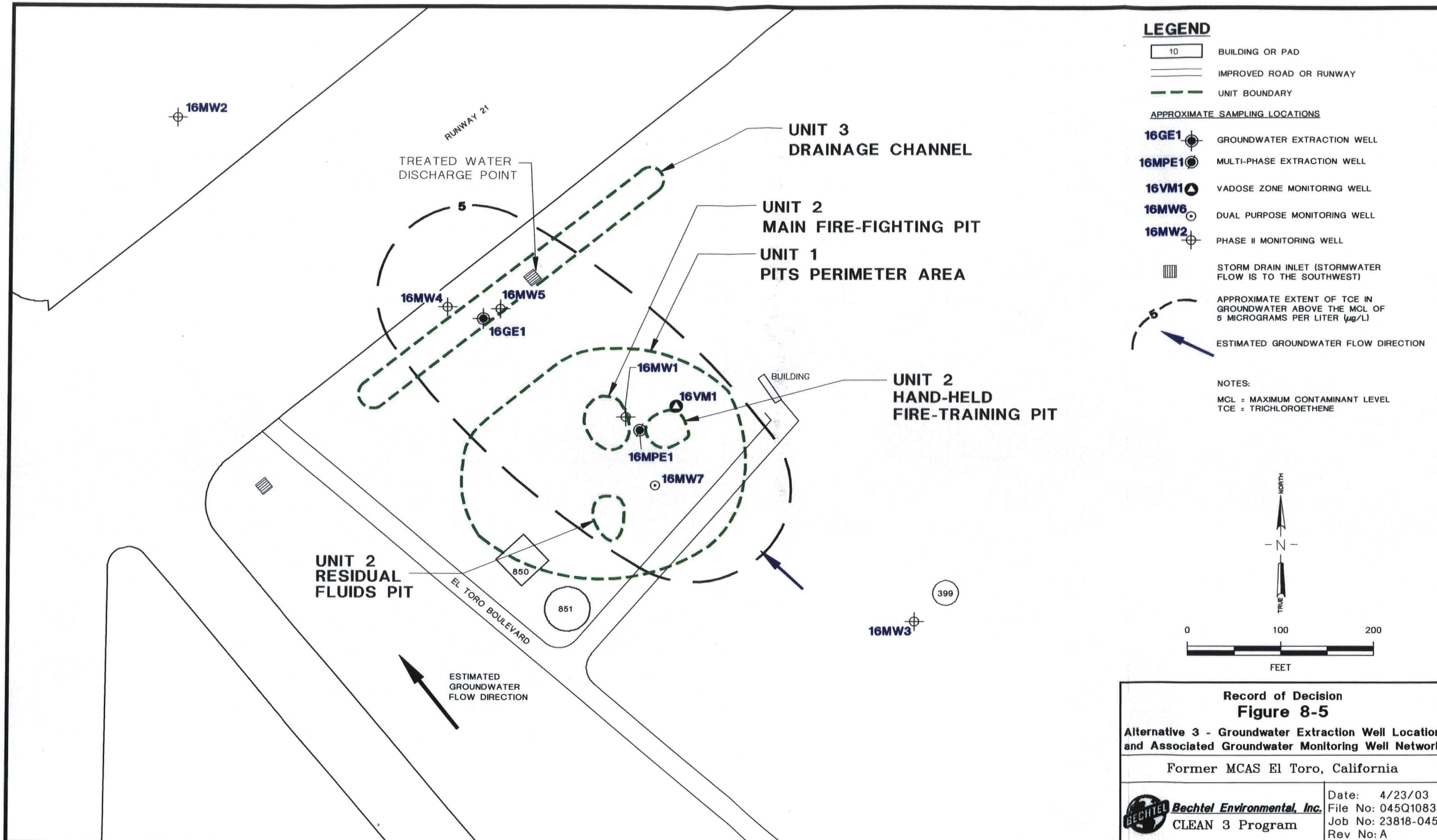
8.2.3.1 BASIS FOR DOWNGRADIENT GROUNDWATER EXTRACTION AND CONTAINMENT CONCEPTUAL DESIGN

At Site 16, groundwater extraction pilot testing indicates that groundwater flow conditions at the source area beneath the main pit are significantly different from conditions within the footprint of the dissolved plume near the site boundary approximately 160 feet downgradient from the main pit. The average hydraulic conductivity of the saturated sediments beneath the main pit (0.96 foot per day average) is approximately 6.5 times lower than the average hydraulic conductivity of the downgradient saturated sediments (6.24 feet per day average). Average storativity values in both areas are comparable (about 0.015 and 0.025, respectively) (BNI 2002a).

The difference in hydraulic conductivity is evident in the extraction rate and the capture zone radius that can be achieved through pumping of comparably designed wells constructed at each location. Due to the significantly lower hydraulic conductivity in the vicinity of the main pit, extraction well 16MPE1 (Figure 8-4) could be pumped at a sustainable rate of only about 0.45 gallons per minute (gpm) and aquifer drawdown was very limited (approximately 1 foot at a distance of about 20 feet from the extraction well). Based on the results of the MPE pilot testing, the capture zone generated by a single extraction well (16MPE1) operating in the vicinity of the main pit would be insufficient to contain the TCE-contaminated groundwater plume. In addition, even if numerous additional extraction wells were constructed and operated in the vicinity of the main pit, it is unlikely that the wells in the area could completely contain the plume. Furthermore, based on groundwater extraction rates and resulting groundwater concentrations in the TCE-contaminated groundwater plume obtained from 16MPE1, this approach is expected to have little influence on plume remediation in the vicinity of the main pit.

Conversely, because of the greater hydraulic conductivity observed in the area downgradient of the main pit, pumping of extraction well 16GE1 at a rate of about 16 gpm during the groundwater extraction pilot test generated over 6 feet of drawdown at a comparable 21-foot distance. That magnitude of drawdown suggests that the capture zone generated in the vicinity of well 16GE1 would be much larger than at 16MPE1.

Recognizing these site-specific conditions, the conceptual design for a groundwater extraction alternative at Site 16 focuses on achieving complete containment of the dissolved TCE plume downgradient of the main pit through groundwater extraction. The results of groundwater extraction pilot testing conducted at well 16GE1 and the capture zone generated during pumping of well 16GE1 at approximately 16 gpm suggest



Record of Decision

Figure 8-5

Alternative 3 - Groundwater Extraction Well Location and Associated Groundwater Monitoring Well Network

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Date: 4/23/03
File No: 045Q10838
Job No: 23818-045
Rev No: A

that the existing well should be capable of achieving complete hydraulic containment of the plume.

8.2.3.2 GROUNDWATER MODELING

Groundwater modeling performed during the FFS confirmed that well 16GE1, pumping at a rate of approximately 16 gpm, would have a large enough capture zone to contain the current plume. The modeling results also indicate that after an estimated 9 years of groundwater extraction, TCE concentrations in groundwater beneath the main pit would decline to less than the MCL of 5 µg/L.

8.2.3.3 DISCHARGE OF TREATED GROUNDWATER

Under Alternative 3, TCE-contaminated groundwater extracted from well 16GE1 would be treated on-site using the LGAC adsorption treatment process that proved effective for this purpose during the MPE pilot study. The system would include a flow meter to document the volume of groundwater extracted for treatment, plus influent and effluent sampling ports to document the concentrations of VOCs entering the system and the quality of the discharged groundwater following treatment. The groundwater treatment system would be located within a secure, fenced compound, and signs would be placed around the aboveground components of the treatment system to warn the public about the potential for exposure to contaminated groundwater and about the physical hazards associated with operation of the treatment system.

The treated groundwater would be conveyed by piping from the effluent side of the LGAC system to the on-site discharge point, a storm drain inlet located approximately 30 feet east of well 16GE1. An in-line totalizing flowmeter would be installed in the pipeline to measure the total volume of treated groundwater discharged to the storm drain. Upon entering the storm drain at this location, the treated groundwater would be conveyed through the existing storm drain system to Bee Canyon Wash. Because the treated groundwater ultimately would discharge to a surface water drainage channel, discharge of the treated groundwater would comply with the substantive requirements of a general National Pollutant Discharge Elimination System (NPDES) permit. Discharge limits for the surface discharge of treated groundwater at Site 16 are discussed in Section 11.

8.2.3.4 MONITORING

Monitoring, which is also an integral component of conceptual design for this alternative, includes three different elements: monitoring of organic compound concentrations in the groundwater influent to the LGAC treatment system, monitoring of the treated groundwater effluent from the LGAC system, and monitoring of *in situ* groundwater quality at Site 16. The purpose of monitoring the groundwater influent to the treatment system is to document the concentrations of contaminants extracted at well 16GE1. The purpose of monitoring the treatment system effluent is to confirm that the LGAC system is effectively removing the VOCs and other organic compounds in groundwater and to verify that the treated water being discharged to the storm drain is in compliance with the substantive requirements of a general NPDES permit. The purpose of *in situ* groundwater monitoring is to document groundwater quality conditions upgradient and downgradient of the extraction well to confirm that the remedy is effectively containing the TCE groundwater plume and preventing downgradient migration.

Influent monitoring performed as part of this conceptual design would include measurements of the extraction well pumping rate and the total volume of groundwater delivered to the treatment system and analysis of influent samples. The influent samples would be analyzed for halogenated and aromatic VOCs, SVOCs, and TPH.

Effluent monitoring is the most important and comprehensive element of the monitoring program for Alternative 3 because it pertains to the quality of the groundwater discharged from the treatment system and released back into the environment. Effluent monitoring would consist of measurements of the total volume of treated groundwater discharged to the storm drain and analyses of treated groundwater samples. Effluent samples would be analyzed for halogenated and aromatic VOCs, SVOCs, TPH, hardness, total nitrogen, sulfide, TDS, total suspended solids, and toxicity testing.

Groundwater monitoring provisions of the conceptual design for Alternative 3 would consist of regular sampling of the seven monitoring wells for this alternative (Figure 8-4). Extraction well 16GE1 would be monitored using influent sampling. Samples collected from the seven wells would be analyzed for halogenated and aromatic VOCs, SVOCs, and TPH. The final number and locations of monitoring wells, frequency of monitoring, and types of analyses would be determined during the design phase for this alternative.

If during any quarter the effluent analytical results indicate that discharge to surface water is in exceedance of the substantive requirements of a general NPDES permit, the update report would also include a statement of the corrective actions undertaken or proposed to bring the treated groundwater effluent back into full compliance with the discharge requirements at the earliest time possible, along with a timetable for implementation of any corrective action. Furthermore, if operation of the Alternative 3 remedy temporarily ceases and no water is discharged during the monitoring period, a letter to that effect would be submitted to the regulatory agencies in lieu of an update report. The monitoring and reporting frequency and contents of the inspection reports will be described in the Remedial Design reports.

Section 9
SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis that was conducted to evaluate the relative performance of each remedial alternative in relation to the nine evaluation criteria outlined in CERCLA Section 121(b) as amended. The purpose of the comparative analysis is to identify the relative advantages and disadvantages of each alternative. The evaluation criteria are based on requirements promulgated in the NCP.

The CERCLA evaluation of nine criteria is categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. Generally, the modifying criteria are taken into account after public comment is received on the proposed plan. As stated in the NCP (40 C.F.R. § 300.430[f]), the evaluation criteria are arranged in a hierarchical manner that is then used to select a remedy for the site based on the following categories:

- threshold criteria
  - overall protection of human health and the environment
  - compliance with ARARs
- primary balancing criteria
  - long-term effectiveness and permanence
  - reduction of toxicity, mobility, or volume
  - short-term effectiveness
  - implementability
  - cost
- modifying criteria
  - state acceptance
  - community acceptance

9.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Assesses whether a cleanup remedy provides adequate public health protection and describes how health risks posed by the site will be eliminated, reduced, or controlled through treatment, engineering controls, or institutional and regulatory controls.

Alternative 1 (no action) is not considered protective of human health and the environment. This alternative would not alter the current or potential future risks to human health and the environment. Although groundwater from the shallow groundwater unit is not currently used for domestic purposes, TCE is present at concentrations that exceed drinking water standards. Under the no action alternative, it is possible that a future resident could construct a well on the property and use water from the well for potable purposes. In addition, even though the concentration of TCE is anticipated to decrease in time through natural processes to a value below drinking water standards, in the absence of monitoring, it is not possible to determine when this alternative may become protective in the future.

Alternatives 2 and 3, which include monitoring and institutional controls, would prevent exposure to contaminated groundwater through deed restrictions prohibiting drilling of wells or extraction of groundwater from areas within the plume. Monitoring would be used to track the progress of natural processes acting to reduce the concentration of VOCs or hydraulic containment activities. Because these alternatives eliminate the potential for exposure to contaminated groundwater (and, thus, sever the pathway for risk due to groundwater) until drinking water standards are reached, Alternatives 2 and 3 are both considered protective of human health and the environment.

9.2 COMPLIANCE WITH ARARs

Addresses whether a cleanup remedy will meet all federal, state, and local environmental statutes or requirements.

Pursuant to Section 121(d)(1) of CERCLA (42 U.S.C. § 9621[d]), remedial actions must attain a degree of cleanup that assures protection of human health and the environment. Additionally, remedial actions that leave hazardous substances, pollutants, or contaminants on-site must meet substantive standards, requirements, limitations, or criteria that are ARARs. Federal ARARs for any site may include requirements under federal environmental laws. State ARARs include promulgated requirements under state environmental or facility siting laws that are more stringent than federal ARARs and that have been identified by the state in a timely manner.

CERCLA Section 121 states that at the completion of a remedial action, a level or standard of control required by an ARAR will be attained for wastes that remain on-site. In addition, the NCP, 40 C.F.R. § 300.435(b)(2), requires compliance with ARARs during the remedial design/remedial action.

A discussion of compliance with ARARs is not appropriate for Alternative 1 because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Section 121(e), 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for a Superfund remedy, including the requirements to meet ARARs, are not triggered by the no action alternative (U.S. EPA 1991).

Alternatives 2 and 3 would be conducted in compliance with all ARARs for Site 16. Alternative 2 consists of MNA and institutional controls. ARARs for this alternative include groundwater protection standards, monitoring requirements, requirements for characterization of wastes, and requirements for implementation of land-use controls. In addition to monitoring and land-use controls, Alternative 3 contains provisions for hydraulic containment, treatment of extracted groundwater, and disposal of treated groundwater to a nearby storm drain. Residuals (spent carbon) will be characterized and disposed of off-site. Groundwater will also be characterized, and double-walled piping will be used in areas where contamination is shown to have the toxicity characteristics that would classify it as RCRA hazardous waste. As discussed in the FFS Report, disposal of groundwater at Site 16 is considered an on-site activity even though the discharged groundwater will eventually migrate off-site to Bee Canyon Wash (BNI 2002b). Therefore, the CERCLA permit exclusion applies to this activity.

9.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Refers to the ability of a remedy to continue protecting human health and the environment over time after the cleanup action is completed.

Modeling of groundwater at Site 16 indicates that cleanup goals protective of human health and the environment will be achieved in 19 years under Alternatives 1 and 2 and in 9 years under Alternative 3. Furthermore, because residual TCE in vadose zone soil beneath the main pit is no longer able to mass load groundwater to concentrations exceeding the MCL, the reduction in TCE concentrations that would occur under all three alternatives is expected to be permanent. Despite these considerations, the effectiveness and permanence of Alternative 1 is rated as "low" because this alternative provides no means for verifying that the necessary risk reduction has been achieved. In contrast, the long-term effectiveness and permanence of Alternatives 2 and 3 are rated as "high" because both alternatives incorporate the monitoring programs necessary to document that the predicted risk reduction has actually occurred.

9.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Refers to the degree to which a cleanup alternative uses treatment technologies to reduce 1) harmful effects to human health and the environment (toxicity), 2) the contaminant's ability to move (mobility), and 3) the amount of contamination (volume).

Although Alternatives 1 and 2 do not include active treatment of contaminants in groundwater, reduction of toxicity and mobility of contaminants would occur slowly through natural *in situ* physical processes such as dilution, dispersion, and adsorption. No reduction in volume would be achieved. Therefore, reduction of contaminant toxicity, mobility, and volume achieved under Alternatives 1 and 2 is considered moderate.

In contrast, Alternative 3 is rated high because it reduces contaminant mobility through hydraulic containment of the VOC plume and contaminant volume through groundwater extraction and LGAC treatment. Furthermore, the net long-term result of groundwater extraction and treatment is a reduction in maximum TCE concentrations to levels below the 5 μg/L MCL.

9.5 SHORT-TERM EFFECTIVENESS

Assesses how well human health and the environment will be protected from impacts due to construction and implementation of a remedy. Also considers time to reach cleanup goals.

This criterion focuses on how well the alternatives protect human health and the environment during construction activities and implementation of the remedy until remedial objectives have been met. Under Alternative 1, no remedial activity would be performed. Because no additional exposure to workers or the public would occur as a result of this alternative, the short-term effectiveness is rated the highest of all alternatives.

Alternative 2 would involve groundwater sampling and monitoring well installation should an additional downgradient monitoring well be necessary in the future. The sampling activities would have limited potential to expose workers and the public to contaminated groundwater generated during well purging. Potential on-site exposures and risks from sampling would be controlled through use of personnel protection equipment, monitoring, and compliance with a site-specific safety and health plan. Impacts to the surrounding community or environment are expected to be negligible. Risks would also be low because of the generally low VOC concentrations and the small volume (12 to 15 gallons) of purge water that would be generated during each round of sampling.

Construction of an additional downgradient well, if necessary, should cause only minor disturbance, would have almost no environmental impact, and would pose relatively low risk to workers and the public. The greatest risks are assumed to be those generally associated with construction activities. Exposure of the community or Station personnel to well-construction activities would be limited because Site 16 is located in the middle of the airfield, the drilling activities would not generate a large volume of dust that would affect surrounding communities, and soil and groundwater are not expected to be contaminated in the area where the additional monitoring well would be located. However, minor noise, traffic, and other inconveniences typically associated with drilling activities would likely exist for the duration of construction.

Because Alternative 2 involves a greater potential risk to maintenance and construction workers than does the no action alternative, the short-term effectiveness of Alternative 2 is considered moderate.

Alternative 3 involves groundwater extraction, LGAC treatment of VOC-contaminated groundwater, discharge of treated water on-site to the storm sewer system that drains into Bee Canyon Wash, and sampling the treatment system influent and effluent and groundwater. Construction of the LGAC treatment system and the short (approximately 30 feet) discharge pipeline to the nearest storm drain inlet should cause only minor disturbance, would have limited environmental impact, and would present relatively low risk to workers and the public. The greatest risks to workers during construction are assumed to be the physical and mechanical hazards generally associated with construction activities. Similarly, because Site 16 is located in the middle of the airfield, the construction activities would not be expected to generate a large volume of dust or noise that would affect surrounding communities, although some increased traffic would be expected.

The greatest risk to both workers and the public during operation of the system would be potential exposure to untreated, VOC-contaminated groundwater. However, the potential for exposure will be minimized by conveying the contaminated groundwater by way of a closed system from the point of extraction to the point of posttreatment discharge. In addition, even the initial concentrations of VOCs (particularly TCE) in the extracted groundwater are not expected to pose a significant risk, and those concentrations are expected to decline throughout the remedy duration to levels that are less than MCLs for all reported VOCs. Warning signs posted around the extraction well and treatment system location would also further minimize potential exposures to the public.

Maintaining the extraction and treatment equipment, changing out and transporting the spent carbon, and sampling the influent, effluent, and groundwater are also activities that would present a limited potential for exposure of workers and the public to contaminated wastes. Potential risks from maintenance and sampling are considered low because of the generally low exposure time, low VOC concentrations, and the small volume (about 12 gallons) of purge water that would be generated during each round of sampling. These risks would be further minimized by adherence to site-specific safety and health and maintenance and monitoring plans. Spent carbon would be transported by qualified contractors.

Although the risks from Alternative 3 could be readily controlled, the short-term effectiveness of this alternative is considered the lowest of all three alternatives because it would offer the most opportunity for exposure to contaminants.

Modeling performed during the FFS showed that Alternatives 1 and 2 are expected to achieve cleanup goals in approximately 19 years. Alternative 3 is expected to achieve cleanup goals in approximately 9 years.

9.6 IMPLEMENTABILITY

Refers to the technical feasibility (how difficult the remedy is to construct and operate) and administrative feasibility (coordination with other agencies) of a remedy. Factors such as availability of materials and services needed are considered.

Alternative 1 would be the most easily implemented alternative from a technical perspective because it would involve no on-site construction or other remedial activity. Alternative 1 is rated highest of the alternatives. Alternative 2 would be the next easiest alternative to implement because monitoring would be performed using existing monitoring wells (with one new well added later only if required). Monitoring, constructing monitoring wells, and implementing deed restrictions would involve standard, proven practices known to be readily implementable. No difficulties regarding feasibility, availability of equipment and services, or schedule are anticipated. Alternative 2 is rated as moderate. Alternative 3 is considered more difficult to implement than Alternative 2 because it involves extraction, treatment, and disposal of groundwater in addition to monitoring and deed restrictions. Therefore, Alternative 3 is rated low when compared to the other alternatives.

9.7 COST

Evaluates the estimated capital costs and present worth in today's dollars required for design and construction and long-term operation and maintenance costs of a remedy.

There is no cost associated with Alternative 1.

The costs for Alternatives 2 and 3 were developed using the remedial action cost engineering requirements (RACER) system developed by the United States Air Force. RACER models are based on generic engineering solutions for environmental projects, technologies, and processes. These solutions are derived from historical project information, government laboratories, construction management agencies, vendors, contractors, and engineering analysis. RACER cost estimates are made site specific through modifications of the geographic and project-specific factors.

The estimated net present worth (NPW) costs for Alternatives 2 and 3 are shown in Table 9-1. Cost estimate details are provided in the FFS Report for Site 16.

The estimated NPW cost (rounded to the nearest $1,000) for Alternative 2 is $1,166,000 and, for Alternative 3, the estimated NPW cost is $2,446,000.

Although the cost estimation for Alternative 2 assumes that an additional monitoring well would be constructed midway through the remedy, the most significant portion of the cost for this alternative would be associated with the 20-year groundwater monitoring program (19 years for the remedy and 1 year for the postremedy). In contrast, despite a duration that is less than half that of Alternative 2, the total cost for Alternative 3 would be significantly higher, primarily because of the capital costs for LGAC treatment system procurement and installation, the O&M costs associated with groundwater extraction and treatment, and the costs for effluent monitoring necessary to comply with the substantive requirements of a general NPDES permit for discharges to surface water (see Section 11 for a discussion of this permit). This alternative would also include lesser, though still significant, groundwater and treatment system influent monitoring costs.

On the basis of this cost comparison, Alternative 2 is rated high and Alternative 3 is rated moderate.

9.8 STATE ACCEPTANCE

Reflects whether the state of California's environmental agencies agree with, oppose, or have no objection to or comment on the Marine Corps' preferred alternative.

DTSC and RWQCB have reviewed the RI and FFS Reports and the Proposed Plan for Site 16 and concur with the selected remedy for soil and groundwater.

Table 9-1
Alternative Cost and Schedule Comparison for Groundwater at Site 16
(all costs are NPW)

Alternative	Capital Cost[a] (thousands of dollars)	O&M Cost[a] (thousands of dollars)	Duration of Remedy (years)[c]	Total Cost[b] (thousands of dollars)
1	NA	NA	NA	NA
2	174	992	19	1,166
3	499	1,947	9	2,446

Notes:
[a] capital cost and O&M cost consist of direct costs and do not include indirect costs, contingency, or escalation
[b] total NPW cost represents the total cost over the life of the project (duration of remedy plus 1 year) and is equal to the sum of capital cost, O&M costs, indirect costs, 20 percent contingency, and escalation
[c] in addition to the remedy duration specified for Alternatives 2 and 3, each alternative includes 1 year of postremedy groundwater monitoring to confirm that the remediation goals have been met

Acronyms/Abbreviations:
NA – not applicable
NPW – net present worth
O&M – operation and maintenance

9.9 COMMUNITY ACCEPTANCE

Evaluates whether community concerns are addressed by the remedy and if the community has a preference for a remedy. Although public comment is an important part of the final decision, the Marine Corps is compelled by law to consider community concerns along with the other criteria.

The Proposed Plan for Site 16 has been presented to the community and discussed at a public meeting. The responsiveness summary portion of this ROD addresses the public's comments and concerns about the selected remedy.

9.10 SUMMARY OF COMPARATIVE ANALYSIS

On the basis of the comparative analysis, the DON selects Alternative 2 as the alternative that represents the best balance of the nine evaluation criteria. Alternative 1 is unacceptable because it would not provide adequate protection for human health and the environment. Alternatives 2 and 3 would meet the ARARs for Site 16 and provide equal protection for human health and the environment from exposure to groundwater.

Alternatives 2 and 3 differ in ease of implementation, short-term effectiveness, and cost. Alternative 2 would be easier to implement because the primary component of this alternative would be a groundwater monitoring program while Alternative 3 would employ groundwater extraction, LGAC treatment, discharge of treated groundwater, and a multifaceted monitoring program. Alternative 2 would also involve less risk to construction and maintenance workers because it would rely on existing monitoring wells and would involve handling of small quantities of contaminated groundwater. Alternative 3 would take approximately half the time to complete the remedy than the time required by Alternative 2. However, the cost to complete Alternative 3 is significantly higher than the cost for Alternative 2. The total NPW cost for Alternative 2 would be $1,166,000, and the NPW cost for Alternative 3 would be $2,446,000.

Section 10
SELECTED REMEDY

On the basis of the RI, FFS, and MPE pilot study at Site 16, the administrative record for this site, a comparative analysis of alternatives for site cleanup, and an evaluation of all comments submitted by interested parties during the public comment period, the DON has selected Alternative 2, monitored natural attenuation with institutional controls, as the remedial action for groundwater at Site 16. The selected alternative will include the following components.

- **MNA.** Groundwater modeling performed during the FS showed that concentrations of VOCs will decrease over time, through natural processes, to drinking water standards. Groundwater will be monitored to assure that contaminant concentrations are decreasing over time as expected.
- **Institutional controls.** Institutional controls will be used to protect groundwater monitoring wells, prevent use or disturbance of groundwater, and maintain a positive drainage over the main pit. These restrictions will be described in the preliminary and final remedial design reports to be developed and submitted to the FFA signatories for review pursuant to the FFA. The remedial design reports will identify procedures to determine when cleanup standards have been met and the parties involved in this determination. The restrictions described in the remedial design reports will be removed when cleanup goals have been determined to be met.
- **Vadose zone monitoring.** Vadose zone monitoring will be performed to confirm the results from the multiphase extraction pilot test that showed that VOCs had been reduced to levels that are not likely to impact groundwater above drinking water standards.
- **Site grading.** The main pit will be graded (i.e., filled in with clean soil from an off-site source) to reduce the potential for infiltration by making the area higher than surrounding portions of the site. The grading will direct rainfall runoff away from the main pit toward storm drains located approximately 150 feet away.

The selected alternative is believed to provide the best balance of trade-offs among the alternatives with respect to the evaluation criteria. On the basis of the information available at this time, the DON believes the preferred alternative offers:

- superior or equivalent performance for the NCP evaluation criteria of short-term effectiveness, long-term effectiveness and permanence, implementability, compliance with ARARs, and overall protection of human health and the environment;
- a cost-effective means of accomplishing the RAOs for the site; and
- regulatory agency acceptance.

Table 10-1 summarizes the cost estimate for the selected alternative at Site 16. The cost estimate includes capital costs and monitoring and reporting costs assumed to extend 20 years. The 20-year time frame does not necessarily reflect the duration of the monitoring activities at the site; the discontinuation or prolongation of monitoring activities will be determined on the basis of the results of the 5-year reviews.

Table 10-1
Alternative 2 – RACER Cost-Estimate Summary

Category	Capital Cost	Annual Average	5th Year	Total[a]
Engineering/Design/Monitoring Plan				
Predesign study, remedial design, and MNA plan	$77,000			$77,000
Construction Costs				
Monitoring well construction[b]	$71,000			$71,000
Pump control and sampling equipment procurement (pump controller/compressor unit, electronic water level meter, water quality flow cell, and turbidity meter)[c]	$53,000			$53,000
Backfill main pit with borrow material and sod	$17,000			$17,000
Subtotal Capital Costs[d]				**$218,000**
O&M				**$0**
Monitoring and Reporting				
MNA monitoring[e]		$33,850		$677,000
Annual monitoring report		$11,750		$235,000
5-year review			$30,600	$122,000
Vadose zone closure report (2nd year)				$14,000
Subtotal Monitoring and Reporting Costs				**$1,048,000**
Total				**$1,266,000**
Contingency (20 percent)[f]				$253,000
Escalation[g]				$530,000
Total Other Costs				**$783,000**
Total Cost, Alternative 2				**$2,049,000**
Net Present Value of Alternative 2 (in 2002 dollars)				**$1,166,000**

Notes:
- [a] totals rounded to nearest thousand
- [b] installation of the additional monitoring well occurs in year 11 of this alternative; includes groundwater monitoring field equipment and well-dedicated pump
- [c] groundwater monitoring field equipment and well-dedicated pumps will need to be purchased for four wells (16MPE1, 16MW4, 16MW5, and 16MW7)
- [d] total of engineering and construction costs
- [e] groundwater analyses include VOCs, SVOCs, TPH, alkalinity, chloride, iron II/III, methane, ethene and ethane, nitrate/nitrite, sulfate/sulfite, and total organic carbon; total includes costs for QA/QC of sample analytical results
- [f] contingency is added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects
- [g] an escalation rate of 3 percent per year (compounded annually) has been added to the yearly cost (direct plus O&M plus indirect plus contingency) to reflect annual adjustments to the base year unit cost (January 2001) from the projected start of 01 January 2003 through the duration of the remedy; escalation has not been included in the separate yearly costs for each activity (e.g., construction costs)

(table continues)

Table 10-1 (continued)

Acronyms/Abbreviations:
MNA – monitored natural attenuation
O&M – operation and maintenance
QA – quality assurance
QC – quality control
RACER – Remedial Action Cost Engineering and Requirements
SVOC – semivolatile organic compound
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

Advantages of the selected remedy include its ease of implementation (e.g., it can use monitoring wells that are already in place at the site), its lower cost, and its inclusion of provisions for future assessments to evaluate the continued performance of the action. Alternative 2 is also expected to have less impact on the future use of the site than Alternative 3 because it does not include groundwater extraction or discharge piping or a groundwater treatment system that could interfere with construction or other use of the site and adjacent areas.

U.S. EPA requires that when MNA is selected as the remedy for a site, a contingency remedy must also be identified. The contingency remedy for Site 16 is Alternative 3, downgradient groundwater extraction and containment with institutional controls.

The following sections describe the components of the selected and contingency remedies and provide conditions that would trigger evaluation of the need to implement the contingency remedy.

10.1 GROUNDWATER MONITORING

Groundwater monitoring associated with Alternative 2 was discussed in Section 8.2.2.3. The conceptual locations of the monitoring wells for Site 16 are shown on Figure 8-2. The number and location of groundwater monitoring wells, frequency of monitoring, and type of analysis will be finalized during remedial design.

Monitoring results would be submitted to U.S. EPA, RWQCB, and DTSC on an annual basis. Changes in monitoring frequency (e.g., from semiannually to annually) would require approval of these same agencies.

Upon review of the monitoring reports, the DON may need to implement remedial actions if groundwater contaminants are increasing in concentration or migrating beyond the area covered by institutional controls. If increases in contamination are confirmed, the DON would immediately notify U.S. EPA, RWQCB, DTSC, and the current property owner(s) and would evaluate potential remedial actions that could include resampling, continued monitoring, increased frequency of monitoring, installation and sampling of additional monitoring equipment, or additional remediation measures (e.g., evaluation of a new technology; implementation of the contingency remedy, Alternative 3).

Periodic reviews involving a detailed analysis of the monitoring data would be conducted to determine the adequacy of the remedy and whether more or less monitoring would be required. As required by CERCLA Section 121(c), the periodic reviews would occur at least every 5 years. Results of the periodic review would be documented in a summary report.

10.2 VADOSE ZONE MONITORING

Vadose zone monitoring associated with Alternative 2 was discussed in Section 8.2.2.4. Figure 8-3 summarizes the decision criteria for determining when discontinuation of vadose zone monitoring is appropriate.

10.3 INSTITUTIONAL CONTROLS

Institutional controls are discussed in Section 8.2.2.2.

10.4 PERIODIC REVIEWS

As required by CERCLA Section 121(c), DON will document in a summary report at least every 5 years: 1) whether the remedy is expected to remain protective, 2) any deficiencies identified during the review, and 3) recommendations for specific actions to correct any deficiencies. If necessary, the 5-year review report will include descriptions of follow-on actions needed to achieve, or to continue to assure, protectiveness along with a timetable for these actions.

10.5 CONTINGENCY REMEDY

The contingency remedy for Site 16 consists of the following components.

- One extraction well would be used to achieve containment of the dissolved VOC plume downgradient of the source area.
- Extracted groundwater would be treated using LGAC and discharged to an on-site storm drain.
- Monitoring would be performed to confirm that the remedy is effectively removing VOCs in groundwater and containing the plume and to verify that the discharged groundwater is in compliance with the substantive requirements of NPDES Permit No. CAG918001, General Groundwater Cleanup Permit.
- Institutional controls would be used to protect the extraction and groundwater monitoring wells and associated piping and treatment system, prevent use of groundwater, maintain a positive drainage over the main pit, and allow the DON and FFA signatories access to the site to conduct or oversee monitoring and maintenance. These restrictions would be described in the remedial design reports.

It is assumed that site grading and vadose zone monitoring will be complete prior to the potential implementation of the contingency remedy.

Any of the following criteria would trigger the need to evaluate whether the implementation of the contingency remedy or the use of MNA enhancements is appropriate (determination will be made in consultation with the BCT).

- VOC groundwater concentration data indicate that VOCs have extended or will likely extend farther downgradient than the 1,300 feet from the main pit predicted by the groundwater model.
- VOC groundwater concentration data in the main pit area indicate an increasing trend, suggesting additional containment of the VOC plume is necessary.
- The trend of VOC concentrations in groundwater in the main pit area indicates that natural attenuation will not meet the RAOs in the 19-year time span predicted by the groundwater model.

10.6 TERMINATION OF REMEDIAL ACTION

Vadose zone remediation (i.e., monitoring) will be considered complete when the decision criteria provided on Figure 8-3 indicate that discontinuation of vadose zone monitoring is appropriate. Groundwater remediation will be considered complete when the concentration of TCE in all monitoring wells reaches drinking water standards and remains below drinking water standards in subsequent monitoring conducted for the following year. Performance monitoring will continue as long as contamination remains above required cleanup levels. Typically, once cleanup levels have been achieved, monitoring is continued for a specified period (e.g., 1 to 3 years) to assure that concentration levels are stable and remain below target levels. Remedial design reports will describe the specific procedures that will be used to determine that the cleanup standards have been met.

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Section 11
STATUTORY DETERMINATIONS

Under CERCLA, the DON's primary responsibility is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action must comply with ARARs established under federal and state laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and use permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that, as their principal element, permanently and significantly reduce the volume, toxicity, or mobility of hazardous waste. The following sections discuss how the selected remedy meets these statutory requirements and preferences. Complete discussions are in the FFS Report for Site 16 (BNI 2002b).

Tables are located at the end of this section.

11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

RAOs for Site 16 are concerned with preventing exposure to contaminated groundwater, limiting future migration of contaminants, and reducing the concentrations of VOCs to drinking water standards (MCLs). The selected remedy protects human health and the environment by assuring the continued isolation of contaminated groundwater. Groundwater at Site 16 is not currently used for domestic purposes or for irrigation. Land-use restrictions will be used to prohibit the use of impacted groundwater in the future. Although modeling shows that contaminated groundwater has the potential to migrate downgradient from its current location, monitoring shows that actual migration has been minimal. Groundwater that does migrate off-site moves into an area of more rapid flow where the concentrations are reduced through natural processes such as dispersion. Monitoring would be used to assure that the movement is minimal and that concentrations continue to decrease as expected. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

11.2 COMPLIANCE WITH ARARs

The selected remedial action will comply with all ARARs. Section 121(e) of CERCLA, U.S.C. § 9621(e), states that no federal, state, or local permit is required for remedial actions conducted entirely on-site. Any action that takes place off-site is subject to the full requirements of the federal, state, and local regulations. The chemical- and action-specific ARARs for the selected remedy for Site 16 (and for the contingency remedy should implementation of the contingency remedy be required) are presented in Tables 11-1 and 11-2, respectively, and discussed below. There are no location-specific ARARs for Site 16.

11.2.1 Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. If a chemical has more than one cleanup level, the most stringent level has been identified as an ARAR for this remedial action. The selected remedial action can be implemented to comply with chemical-specific ARARs. Chemical-specific ARARs are discussed below by medium.

11.2.1.1 GROUNDWATER

The substantive provisions of the following requirements were identified as the most stringent of the federal and state groundwater ARARs for remedial actions at Site 16:

- Water Quality Control Plan (WQCP) for the Santa Ana Region, 1995 (specifying water quality objectives and beneficial use)
- federal MCLs listed in the Safe Drinking Water Act (SDWA)
- RCRA groundwater protection standards in *California Code of Regulations* (Cal. Code Regs.) Title (tit.) 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e)

The most stringent of these requirements are the RCRA groundwater protection standards and Cal. Code Regs. tit. 22, § 66264.94 requirements to restore affected groundwater to background conditions, if feasible, or else attain the best water quality that is technically and economically feasible.

The DON has determined that the substantive provisions of Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) constitute relevant and appropriate federal ARARs for groundwater at Site 16. These provisions are considered a federal ARAR because this requirement was approved by U.S. EPA in its 23 July 1992 authorization of the state of California's RCRA program and is federally enforceable. The state of California disagrees with the DON; this regulation is a part of the state's authorized hazardous waste control program, so the state contends that the regulation is a state ARAR and not a federal ARAR. See 55 Fed. Reg. 8765, 08 March 1990, and *United States v. State of Colorado*, 990 F.2d 1565 (1993).

Water Quality Control Plan

Under the SDWA and RCRA, a significant issue in identifying ARARs for groundwater is whether the groundwater can be classified as a source of drinking water. The U.S. EPA groundwater policy set forth in the NCP preamble uses the system in the U.S. EPA Guidelines for Groundwater Classification under the U.S. EPA Groundwater Protection Strategy (NCP, 55 Fed. Reg. 8752–8756). Under this policy, groundwater is classified in one of three categories (Class I, II, or III) based on ecological importance, its ability to be replaced, and vulnerability. Class I is irreplaceable groundwater currently used by a substantial population, or groundwater that supports a vital habitat. Class II consists of groundwater currently used or that might be used as a source of drinking water in the future. Class III is groundwater that cannot be used for drinking water because of its unacceptable quality (e.g., high salinity or widespread naturally occurring contamination) or insufficient quantity. The U.S. EPA guidelines define Class III as groundwater with TDS concentrations over 10,000 milligrams per liter. The aquifer underlying Former MCAS El Toro is classified as a Class II aquifer and is designated by RWQCB as a potential source of drinking water, along with other beneficial uses such as agricultural and industrial.

Safe Drinking Water Act

MCLs under the SDWA are relevant and appropriate requirements for aquifers with Class I and II characteristics and, therefore, are federal ARARs. The point of compliance for MCLs under the SDWA is at the tap. For CERCLA remedies, however, U.S. EPA indicates that MCLs should be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when the waste is left in place (55 Fed. Reg. 8753). At Site 16, MCLs are cleanup goals throughout the VOC plume.

RCRA Hazardous Waste Definition Standards

Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are applicable federal ARARs for determining whether the groundwater is a hazardous waste. Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), 66261.101, 66261.3(a)(2)(C) or (F) are applicable state ARARs for determining whether the groundwater at Site 16 is a hazardous waste. Extracted groundwater will be tested to determine whether it is hazardous waste in accordance with these regulations.

RCRA Groundwater Protection Standards

Cal. Code Regs. tit. 22, § 66264.94 states that concentration limits for RCRA groundwater protection standards are set for RCRA-regulated units. These regulations provide that compounds must not exceed their background levels in groundwater or some higher concentration limit set as part of the corrective action program. A limit greater than background may be approved if the owner can demonstrate that it is not technologically or economically feasible to achieve the background value and that the constituent at levels below the concentration limit will not pose a hazard to human health or the environment. A concentration limit greater than background must never exceed other applicable standards including MCLs established under the federal SDWA (Cal. Code Regs. tit. 22, § 66264.94[e]).

A discussion of the technical and economic infeasibility of remediating groundwater at Former MCAS El Toro to background is presented in Appendix H of the OU-1 Interim Action Feasibility Study Report (JEG 1996). The OU-1 evaluation included groundwater at Site 16. The OU-1 report determined that cleanup of VOCs to background was technologically or economically infeasible. MCLs were determined to be the lowest concentration technologically or economically achievable. This document was reviewed and accepted by U.S. EPA, DTSC, and RWQCB. Therefore, as provided for in Cal. Code

Regs. tit. 22, § 66264.94(e), concentration limits based on MCLs and health-based criteria are considered remedial goals for Site 16.

The RCRA groundwater protection standards are applicable only to RCRA-regulated units, and Site 16 is not considered a RCRA-regulated unit. However, the DON has concluded that substantive provisions of Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) are relevant and appropriate federal ARARs for groundwater potentially affected by releases from this site because the constituents being addressed are similar or identical to those found in RCRA hazardous wastes.

Primary and Secondary MCLs

National primary drinking water standards for organic compounds are found at 40 C.F.R. § 141.61(a). The MCL for TCE has been determined to be a relevant and appropriate requirement for groundwater cleanup. Primary and secondary state MCLs are set forth in Cal. Code Regs. tit. 22, §§ 64431 (Maximum Contaminant Levels—Inorganic Chemicals), and 64444 (Maximum Contaminant Levels—Organic Chemicals). MCLs for inorganics are not ARARs for Site 16 because inorganics are not COCs at this site. In addition, the MCL for TCE at Cal. Code Regs. tit. 22, § 64444(a) is not an ARAR for groundwater cleanup because it is no more stringent than the corresponding federal MCL.

The DON's Position Regarding SWRCB Resolutions 92-49 and 68-16

The DON and the state of California have not agreed whether the State Water Resources Control Board (SWRCB) Resolution (Res.) 92-49 and Res. 68-16 are ARARs for the remedial action at Site 16. Therefore, this ROD documents each party's position but does not attempt to resolve the issue.

The DON recognizes that the key substantive requirements of Cal. Code Regs. tit. 22, § 66264.94 (and the identical requirements of Cal. Code Regs. tit. 23, § 2550.4 and Section III.G of SWRCB Res. 92-49) require cleanup of constituents to background levels unless that is technologically or economically infeasible and an alternative cleanup level will not pose a substantial present or potential hazard to human health or the environment. In addition, the DON recognizes that these provisions are more stringent than the corresponding provisions of 40 C.F.R. § 264.94 and, although they are federally enforceable under RCRA, they are also independently based on state law to the extent that they are more stringent than the federal regulations.

The DON has also determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining remedial action goals, but it is an action-specific ARAR for regulating discharged treated groundwater to surface water. This is discussed in Section 11.2.1.4. The DON has determined that further migration of VOCs through groundwater is not a discharge governed by the language in Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges in order to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The DON's position is that SWRCB Res. 68-16 and Res. 92-49 and Cal. Code Regs. tit. 23, § 2550.4 do not constitute chemical-specific ARARs for this remedial action because they are state requirements and are not more stringent than the federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94. The NCP set forth in 40 C.F.R. § 300.400(g) provides that only state standards more stringent than federal standards may be ARARs (see also CERCLA Section 121[d][2][A][ii]).

The substantive technical standard in the equivalent state requirements (i.e., Cal. Code Regs. tit. 23, division (div.) 3, chapter (ch.) 15 and SWRCB Res. 92-49 and Res. 68-16) is identical to the substantive technical standard in Cal. Code Regs. tit. 22, § 66264.94. This section of Cal. Code Regs. tit. 22 will likely be applied in a manner consistent with equivalent provisions of other regulations, including SWRCB Res. 92-49 and Res. 68-16.

State of California's Position Regarding SWRCB Resolutions 92-49 and 68-16

The state does not agree with the DON determination that SWRCB Res. 92-49 and Res. 68-16 and certain provisions Cal. Code Regs. tit. 23, Division (div.) 3, Chapter (ch.) 15 are not ARARs for this response action. SWRCB has interpreted the term "discharges" in the California Water Code to include the movement of waste from soils to groundwater and from contaminated to uncontaminated water (SWRCB 1994). However, the state agrees that the proposed action would comply with SWRCB Res. 92-49 and Res. 68-16, and compliance with Cal. Code Regs. tit. 22 provisions should result in compliance with Cal. Code Regs. tit. 23 provisions. The state does not intend to dispute the ROD, but reserves its rights if implementation of the Cal. Code Regs. tit. 22 provisions is not as stringent as state implementation of Cal. Code Regs. tit. 23 provisions. Because the Cal. Code Regs. tit. 22 regulation is part of the state's authorized hazardous waste control program, it is also the state's position that Cal. Code Regs. tit. 22, § 66264.94 is a state ARAR and not a federal ARAR (*United States v. State of Colorado*, 990 F.2d 1565 [1993]).

Whereas the DON and the state of California have not agreed on whether SWRCB Res. 92-49 and Res. 68-16 and Cal. Code Regs. tit. 23, § 2550.4 are ARARs for this response action, this ROD documents each of the parties' positions on the resolutions but does not attempt to resolve the issue.

Cleanup Levels

Cleanup levels for groundwater are set at health-based levels, reflecting current and potential use and exposure. TCE is the only chemical of concern at Site 16. The remediation goal for TCE is based on the federal MCL as shown in Table 8-1.

11.2.1.2 SOIL CHEMICAL-SPECIFIC ARARs

Soil is not a medium of concern at Site 16. However, soil cuttings may be generated if it is necessary to construct an additional downgradient monitoring well as part of Alternative 2. In addition, should it become necessary to implement Alternative 3, the contingency remedy for Site 16, spent carbon will be generated during groundwater treatment. Hazardous waste determinations would be made at the time the waste is generated. The characteristic waste levels used to determine whether the wastes are hazardous are applicable requirements for the soil and spent carbon (Table 11-1). If the waste is hazardous, the action-specific requirements identified in Section 11.2.3 for storage prior to off-site disposal would be ARARs.

11.2.1.3 AIR CHEMICAL-SPECIFIC ARARs

Air is not a medium of concern at Site 16 and the selected remedy does not involve discharge to air. If the contingency remedy were to be implemented, the groundwater that will be pumped to the surface will be contained and transferred in airtight piping to an airtight tank treatment system. LGAC is proposed as a treatment technology for groundwater. Once the water meets the discharge criteria, it will be released to the surface water. Therefore, no chemical-specific ARARs were identified for air for either the selected remedy or the contingency remedy. ARARs for dust that would be emitted as a result of grading activities associated with Alternatives 2 and 3 are discussed as action-specific ARARs in Section 11.2.3.

11.2.1.4 SURFACE WATER CHEMICAL-SPECIFIC ARARs

Discharge to surface water is included as an element of the contingency remedy (Alternative 3) for Site 16. The proposed discharge is to the Bee Canyon Wash, which is a tributary to San Diego Creek in the Lower Santa Ana River Basin. Chemical-specific ARARs for this discharge include the following:

- Water quality standards promulgated in 40 C.F.R. § 131.36 and 131.38
- WQCP for the Santa Ana River Basin
- Inland Surface Waters Plan/Enclosed Bays and Estuaries Plan
- SWRCB Res. 68-16

NPDES Permit No. CAG918001 will be used as guidance to comply with these ARARs as discussed below.

Water Quality Standards

On 22 December 1992, U.S. EPA promulgated federal water quality standards under the authority of the federal Clean Water Act (CWA) Section 303(c)(4)(B), 33 U.S.C. ch. 26, § 1313 in order to establish water quality standards required by the CWA where the state of California and other states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the *Federal Register* including the amendments of the National Toxics Rule (60 Fed. Reg. 22228 [1995]). The water quality standards, as amended, are codified at 40 C.F.R. § 131.36. The water quality standards contained in 40 C.F.R. § 131.36(a) are applicable federal ARARs for discharge to or cleanup of surface water.

- U.S. EPA promulgated a rule on 18 May 2000 to fill a gap in California water quality standards that was created in 1994 when a state court overturned the state's water quality control plans containing water quality criteria for priority toxic pollutants. The rule is commonly called the California Toxics Rule (CTR). The rule is codified at 40 C.F.R. § 131.38. These federal criteria are legally applicable in the state of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the CWA. The standards for consumption of water are not pertinent to the selected remedy because Bee Canyon Wash is not a potential source of drinking water. Therefore, the standards for consumption of organisms only are applicable and are listed in Table 11-3.

  These standards of the CTR apply to the state's designated uses and "supersede any criteria adopted by the State, except when State regulations contain criteria which are more stringent for a particular use in which case the State's criteria will continue to apply." The CTR water quality standards listed in Table 11-3 are ARARs as implemented through the WQCP.

  The DON will comply with the CTR by using the discharge specifications of the RWQCB General NPDES permit for treated groundwater as guidance, as discussed below.

Water Quality Control Plan, Santa Ana River Basin

The substantive provisions of the Basin Plan (RWQCB 1995) at Chapter 3 for beneficial uses and Chapter 4 for water quality objectives for the Bee Canyon Wash tributary to the San Diego Creek in the Lower Santa Ana River Basin are state ARARs for proposed discharges to surface water under Alternative 3. Based on Table 3-1 of the WQCP, the municipal beneficial use is excepted for the Bee Canyon Wash, and it has intermittent beneficial uses for groundwater recharge, water contact recreation, noncontact water recreation, warm freshwater habitat, and wildlife habitat. There are no numerical water quality objectives for Bee Canyon Wash in the WQCP (RWQCB 1995; Table 4-1). The narrative water quality objectives for inland surface waters for toxic substances are as follows:

> "Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health. The concentrations of contaminants in waters which are existing or potential sources of drinking water shall not occur at levels which are harmful to human health. The concentrations of toxic pollutants in the water column, sediments or biota shall not adversely affect beneficial uses."

These narrative standards may apply to the chemicals of concern at Site 16. Other narrative standards for inland surface waters may apply to constituents of treated groundwater that are proposed to be discharged to the surface. The DON will comply with these ARARs by using the discharge specifications of the general NPDES permit as guidance as discussed below.

Inland Surface Waters Plan/Enclosed Bays and Estuaries Plan

The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California (SWRCB 2000), which is Phase 1 of the Surface Waters Plan and the Enclosed Bays and Estuaries Plan (Inland Surface Waters Plan), was effective on 28 April 2000 for priority pollutant criteria promulgated for California by U.S. EPA through the National Toxics Rule (40 C.F.R. § 131.36) and to the priority pollutant objectives established by the RWQCBs in their water quality control plans (Basin Plans). The Inland Surface Waters Plan was effective on 18 May 2000 for priority pollutant criteria promulgated by U.S. EPA through the California Toxics Rule (40 C.F.R. § 131.38). The Inland Surface Waters Plan implements the federal numeric water quality criteria (40 C.F.R. § 131.36 and 131.38) by requiring that they serve as the basis for determining water quality-based effluent limitations for point sources that protect beneficial uses. The determination whether an effluent limitation is required is based on whether the point-source discharge may cause, have a reasonable potential to cause, or contribute to an excursion above any applicable priority pollutant criterion or water quality objective. If an effluent limitation is required, it can be calculated using the appropriate dilution credit and ambient background concentration for the site, or it could be based on the total maximum daily load if one is in effect.

The substantive requirements for determining whether an effluent limitation is required and the methodology for calculating the effluent limitation found in Sections 1.3 and 1.4 of the Inland Surface Waters Plan are applicable state ARARs for discharges that cause, have a reasonable potential to cause, or contribute to an excursion above any applicable priority pollutant criterion or objective into inland surface waters, enclosed bays, and estuaries (nonocean surface waters). Other sections of the Inland Surface Waters Plan are not ARARs because they are no more stringent than federal ARARs.

SWRCB Res. 68-16, Statement of Policy With Respect to Maintaining High Quality of Waters in California

SWRCB Res. 68-16 is a state ARAR for discharges to surface waters that result from implementation of remedial Alternative 3. The DON will comply with this ARAR by using the general NPDES permit discharge specifications discussed below as guidance.

NPDES Permit Requirements

The DON has determined that the substantive effluent limitations of CWA Section 301(b) that meet technology-based requirements, including best available technology, and are economically achievable are applicable for the contingency remedy (Alternative 3) discharge of treated groundwater to surface water.

RWQCB has indicated that it intends to require authorization to discharge pursuant to an NPDES permit if the selected remedial action for Site 16 includes surface water discharge.

The DON has determined that Section 121(e)(1) of CERCLA and the corresponding provision in the NCP (40 C.F.R. § 300.400[e][1]) apply to the discharge of treated groundwater resulting from the remediation of Site 16 groundwater and that an NPDES permit is, therefore, not required for that discharge. The DON intends to construct and operate the groundwater treatment system entirely on-site. The treated groundwater will be discharged to a nearby storm drain, which will transport the treated water and ultimately discharge it into waters of the United States at an off-site location. U.S. EPA has consistently maintained that the off-site migration of extracted water that has been treated under the response action so that it complies with ARARs is consistent with the on-site permit exclusion in Section 121(e) of CERCLA and, therefore, does not constitute an off-site response action that requires an NPDES permit. (See "In the Matter of the Former Weldon Ordnance Works, Weldon Springs, Missouri," Federal Facility Docket No. VII-90-F-0033, 01 November 1995.) The DON agrees with this interpretation of CERCLA and the NCP.

Legal counsel from the DON and RWQCB have communicated regarding RWQCB's requirements for regulation of discharges to surface waters under the NPDES and have "agreed to disagree" on this matter. The DON and RWQCB positions are documented in correspondence dated 27 December 2000 (DON 2000), 26 January 2001 (RWQCB 2001), and 08 March 2001 (DON 2001).

On 10 July 1998, RWQCB adopted NPDES Permit No. CAG918001, General Groundwater Cleanup Permit, for discharges of extracted and treated groundwater resulting from the cleanup of groundwater polluted by petroleum hydrocarbons and/or solvents. The DON will use the general permit and authorization to discharge thereunder as guidance to comply with federal effluent limitations and other federal and state ARARs identified for the discharge of groundwater to surface water proposed at Site 16. The substantive provisions that will be used as guidance are the numerical discharge limits listed in Table 11-3. The procedural and administrative provisions for obtaining permit coverage and fees are not substantive.

11.2.2 Location-Specific ARARs

No location-specific ARARs were identified for Site 16.

11.2.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the particular remedial activities conducted at the site. Action-specific ARARs for the selected alternative are presented in Table 11-2 and include monitoring requirements, waste-generating requirements, dust-control requirements, and requirements for implementing institutional controls.

11.2.3.1 MONITORING

A groundwater detection monitoring program will be implemented for Site 16 as required by Cal. Code Regs. tit. 22, § 66264.98(b), (c), (f), (g), and (i). The monitoring program will meet the substantive requirements of Cal. Code Regs. tit. 22, § 66264.93 and .97(b), (d), and (e)(2)–(5). Evaluation monitoring and corrective action will be performed in accordance with Cal. Code Regs. tit. 22, § 66264.99(b), (c), (e), (f), and (g) and § 66264.100(b), (c), (d), and (g)(1) and (3) if there is measurably significant evidence of a release during the detection monitoring program. A point of compliance has not been designated for Site 16 because waste is not being left in place. Cleanup goals apply to all portions of the groundwater plume.

11.2.3.2 WASTE CHARACTERIZATION AND ACCUMULATION

RCRA requirements for determining whether the waste is hazardous at Cal. Code Regs. tit. 22, § 66262.10(a) and 66262.11 and for laboratory analysis if required at Cal. Code Regs. tit. 22, § 66264.13(a) and (b) are applicable federal requirements for the extracted groundwater and for soil and monitoring wastes at Site 16. The hazardous waste determination and required analysis will be conducted using the ARARs identified in Table 11-1. If the groundwater or soil is hazardous, substantive requirements of Cal. Code Regs. tit. 22, § 66264.34 for accumulation of waste and § 66264.171 through 174, 175(a) and (b), and 178 for storing waste in containers would be applicable federal requirements.

The waste groundwater accumulated during sampling, the soil from drill cuttings, and the treatment residuals such as spent carbon will be disposed of off-site. If the wastes are determined to be hazardous, then the appropriate requirements outlined in Table 11-2 for on-site packaging, labeling, marking, and placarding these materials for final disposal need to be followed.

11.2.3.3 DUST-CONTROL REQUIREMENTS

Requirements that have been incorporated into the State Implementation Plan and are therefore considered to be federal ARARs for this action include substantive requirements of South Coast Air Quality Management District fugitive dust Rules 403, 404, and 405. Requirements that have not been incorporated into the State Implementation Plan and are therefore considered state requirements include Rule 401. Rules 401(a), 403, 404, and 405 regulate release of dust and particulate matter that could occur during grading of soil. The DON will comply with these action-specific federal and state ARARs by employing standard dust suppression measures such as wetting the soil during the remedial action phase.

11.2.3.4 INSTITUTIONAL CONTROLS

State statutes that have been accepted by the DON as ARARs for implementing institutional controls and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the *California Civil Code* (Cal. Civ. Code) § 1471 and *California Health and Safety Code* (Cal. Health & Safety Code) §§ 25202.5, 25222.1, and 25233(c). DTSC promulgated a regulation on 19 April 2003 regarding "Requirements for Land Use Covenants" at Cal. Code Regs. tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON.

The substantive provisions of Cal. Civ. Code § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the Environmental Restriction Covenant and Agreement and run with the land.

The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." These substantive provisions will be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

Cal. Health & Safety Code § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. Cal. Health & Safety Code § 25222.1, Land Use Covenant Agreement, itself is in the form of an agreement, and this procedural form does not qualify as a legally binding "applicable or relevant and appropriate" requirement under CERCLA because it is administrative (procedural) in nature. The substantive provision of Cal. Health & Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property." Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances from prohibited uses. The DON will comply with the substantive requirements of Cal. Health & Safety Code § 25222.1 by incorporating the CERCLA use restrictions (Section 8.2.2.2 of this ROD) into the DON's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471 and into the Environmental Restriction Covenant and Agreement. The substantive provisions of Cal. Health & Safety Code § 25222.1 may be interpreted in a manner that is consistent with the substantive provisions of Cal. Civ. Code § 1471. The covenants would be recorded with the deed and run with the land.

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the DON and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25221.1, 25233(c) and Cal. Civ. Code § 1471 shall also be implemented through the deed between the DON and the transferee.

U.S. EPA does not agree with the DON and DTSC that the sections of the Cal. Civ. Code and Cal. Health & Safety Code cited above are ARARs because they fail to meet the criteria for ARARs pursuant to U.S. EPA guidance (i.e., they are administrative, not substantive, requirements that establish a discretionary way to implement land-use restrictions). However, U.S. EPA agrees that the substantive provisions of the recently promulgated regulation (Cal. Code Regs. tit. 22, § 67391.1) providing for the execution of a land-use covenant between DON and DTSC is a "relevant and appropriate" state ARAR.

11.2.3.5 RCRA TANK SYSTEM REQUIREMENTS

The contingency remedy (Alternative 3) includes treatment of groundwater by carbon in a tank system. If groundwater is determined to be a hazardous waste, the RCRA tank system requirements at Cal. Code Regs. tit. 22, § 66264.192, § 66264.193(b), (c), (d), (e), and (f), and § 66264.197(a) will be applicable ARARs. These regulations include design, secondary containment, and closure requirements for tank systems that treat hazardous waste.

11.3 COST-EFFECTIVENESS

Alternative 2, the selected remedy, has been determined to provide overall effectiveness proportional to its costs; it is, therefore, considered cost-effective. The order-of-magnitude net present worth is estimated at $1,166,000.

The estimated costs of the selected remedy are less than the costs associated with Alternative 3, which involves more active remediation. As discussed in the summary of the comparative analysis of alternatives (Section 9.10), Alternative 2 effectively provides the same level of protection to human health and the environment as Alternative 3 because both alternatives use land-use controls to prevent exposure to contaminated groundwater. In addition, modeling has shown that natural processes will remediate groundwater in less than 20 years. As a result, the additional costs associated with the containment and treatment of contaminated groundwater are unwarranted. All technologies included in this remedy are readily implementable and have been widely used and demonstrated to be effective.

11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

The DON, U.S. EPA, DTSC, and RWQCB have determined that the selected remedy represents the maximum extent practicable to which permanent solutions and alternative treatment technologies can be used in a cost-effective manner. Of all the alternatives that are protective of human health and the environment and comply with ARARs, the DON, U.S. EPA, and the state have determined that this selected remedy provides the best balance of trade-offs among short-term effectiveness, long-term effectiveness, and permanence, implementability, and cost. The selected remedy is expected to be permanent and effective over the long term as long as land-use restrictions are enforced and monitoring is continued. In the unexpected event that the selected remedy fails to perform as expected, a contingency remedy (Alternative 3) has also been identified for Site 16.

11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because active treatment of groundwater would shorten remediation time only at a much increased cost and would not add to the protectiveness of the remedy, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The low pumping rate and small radius of influence at the hot spot area of Site 16 preclude a remedy in which contaminants could be extracted and treated effectively.

Table 11-1
Chemical-Specific[a] ARARs for Selected Remedy

Requirement	Citation[b]	ARAR Determination	Comments
FEDERAL			
Safe Drinking Water Act (42 U.S.C., ch. 6A, § 300[f]–300[j]-26)[c]			
National primary drinking water standards are health-based standards (MCLs) for public water systems.	40 C.F.R. § 141.61(a)	Relevant and appropriate	The NCP defines MCLs as relevant and appropriate for groundwater determined to be a current or potential source of drinking water, in cases where MCLGs are not ARARs. MCLs are relevant and appropriate for Class II aquifers such as the Irvine Forebay I aquifer. The Santa Ana RWQCB has designated the Irvine Forebay I aquifer for municipal/domestic use (potential drinking water) in addition to other uses. Only the primary standards for organic chemicals (40 C.F.R. § 141.61), specifically VOCs, are ARARs for this action. MCLs for inorganics specified in 40 C.F.R. § 141.11 and 40 C.F.R. § 141.62 are not identified as ARARs because inorganics are outside the scope of this action. Furthermore, it has been determined that Former MCAS El Toro has not contributed to regional groundwater inorganics contamination.
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[c]			
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether hazardous soil or groundwater from monitoring well construction or operation is hazardous. For the contingency remedy, using the RCRA definition of listed hazardous waste, groundwater extracted from Site 16 would not be a listed waste or contain a listed waste. However, there is the potential for groundwater from some areas of one Site 16 TCE plume to exceed TCLP limits for TCE, making it a characteristic hazardous waste.

(table continues)

Table 11-1 (continued)

Requirement	Citation[b]	ARAR Determination	Comments
			The maximum estimated influent concentrations are below TCLP limits. In addition, there is the potential for some of the spent carbon to exceed TCLP limits for TCE, making it a characteristic hazardous waste.
Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Cal. Code Regs. tit. 22, § 66264.94 in the uppermost aquifer underlying the waste management area of concern.	Cal. Code Regs. tit. 22, § 66264.94, except 66264.94(a)(2) and 66264.94(b)	Relevant and appropriate	Applicable for hazardous waste TSD facilities; potentially relevant and appropriate in site-specific circumstances, such as when the source of the waste is unknown but the waste is similar in composition to listed waste or when waste constituents have released or have the potential to release to groundwater. Site 16 is not a TSD facility. However, because the waste in groundwater, in particular TCE, is similar in composition to listed waste, this requirement is determined to be relevant and appropriate.
Clean Water Act of 1977, as Amended (33 U.S.C., ch. 26 §§ 1251–1387[c]			
Water quality standards	40 C.F.R. § 131.36(b) and 131.38	Applicable (contingency remedy only)	Applicable for discharge of treated groundwater to Bee Canyon Wash. The discharge specifications for NPDES Permit No. CAG918001will be used as guidance to comply with these ARARs (see Table 11-3).
Effluent limitations that meet technology-based requirements, including BCPCT and BAT economically achievable.	33 U.S.C., ch. 26, § 1311(b)(2) (CWA § 301[b])	Applicable (contingency remedy only)	Applicable for discharge of treated groundwater to Bee Canyon Wash. The discharge specifications for the NPDES permit are in compliance with this ARAR (see Table 11-3).

(table continues)

Table 11-1 (continued)

Requirement	Citation[b]	ARAR Determination	Comments
STATE			
Cal/EPA Department of Toxic Substances Control[c]			
Definition of "non-RCRA hazardous waste."	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F)	Applicable (groundwater, soil, spent carbon)	Applicable for determining whether soil cuttings or groundwater from construction or operation of monitoring wells are non-RCRA hazardous wastes. For the contingency remedy, using the state definition for listed hazardous waste, groundwater extracted from Site 16 wells and soil removed during well construction are determined not to be listed non-RCRA hazardous waste but will be tested to determine if they meet the criteria for characteristic non-RCRA hazardous waste. If the waste is found to be characteristic non-RCRA hazardous waste, generator requirements are applicable.
State and Regional Water Quality Control Boards[c]			
Authorizes SWRCB and RWQCB to establish in water quality control plans beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality. Authorizes regional water boards to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.	Cal. Water Code, div. 7, §§ 13241, 13243, 13263(a), 13269, and 13360 (Porter-Cologne Water Quality Control Act)	Applicable	The DON accepts the substantive provisions of §§ 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Act, enabling legislation, as implemented through the beneficial uses, WQOs, waste discharge requirements, promulgated policies of the WQCP for the Santa Ana River Basin as ARARs, for groundwater.

(table continues)

Table 11-1 (continued)

Requirement	Citation[b]	ARAR Determination	Comments
Describes the water basins in the Santa Ana River Basin, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.	Water Quality Control Plan Santa Ana River Basin (WQCP) (Cal. Water Code § 13240) Chapters 3 and 4	Applicable	Substantive requirements pertaining to beneficial uses and WQOs for the Irvine Pressure Subbasin are potentially applicable to groundwater cleanup levels. The beneficial uses for the Irvine Forebay I aquifer designated in the Water Quality Control Plan are municipal/domestic use (potential drinking water), agricultural supply, industrial service supply, and industrial process supply. Substantive requirements pertaining to beneficial uses, WQOs and waste discharge requirements for the Bee Canyon Wash are potentially applicable for the discharge of treated groundwater.
Incorporated into all regional board basin plans. Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.	SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	Groundwater beneath Site 16 has been determined to be a potential source of drinking water.
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be	Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Applicable (contingency remedy only)	Applicable for discharges to surface water for remedial action Alternative 3 (contingency remedy).

(table continues)

Table 11-1 (continued)

Requirement	Citation[b]	ARAR Determination	Comments
maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.			
General Groundwater Cleanup Permit for discharges of extracted and treated groundwater resulting from the cleanup of groundwater polluted by petroleum hydrocarbons and/or solvents.	California RWQCB Santa Ana Region Order No. R8-2002-0007, NPDES Permit No. CAG918001, Section A.1.	Not an ARAR/ guidance (for discharge limits for contingency remedy only)	Although on-site CERCLA response actions are exempt from permit requirements under Section 121(e) of CERCLA, the DON considers the substantive requirements of the General Permit to be guidance and a means of assuring compliance with federal and state ARARs for the discharge of treated groundwater to surface water such as water quality standards, effluent guidelines, the WQCP for the Santa Ana River Basin, and SWRCB Res. 68-16.
Requires analysis for each priority pollutant to determine if water-quality-based effluent limitation is required. Provides effluent limitation development methodology.	Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Inland Surface Waters Plan), §§ 1.3 and 1.4	Applicable (contingency remedy only)	Substantive provisions are applicable for the proposed discharge to surface water. This policy implements the federal NTR and CTR criteria for the chemicals listed in Table 11-3.

(table continues)

Table 11-1 (continued)

Notes:
[a] many action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
[b] only the substantive provisions of the requirements cited in this table are ARARs
[c] statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as ARARs; specific ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered ARARs

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
BAT – best available technology
BCPCT – best conventional pollutant control technology
Cal. Code Regs. – *California Code of Regulations*
Cal/EPA – California Environmental Protection Agency
Cal. Water Code – *California Water Code*
C.F.R. – *Code of Federal Regulations*
ch. – chapter
CWA – Clean Water Act
div. – division
DON – Department of the Navy
gpd – gallons per day
MCAS – Marine Corps Air Station
MCL – maximum contaminant level
MCLG – maximum contaminant level goal
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
NPDES – National Pollutant Discharge Elimination System
ppm – parts per million
RCRA – Resource Conservation and Recovery Act
Res. – Resolution
RWQCB – (California) Regional Water Quality Control Board Santa Ana Region
§ – section
SWRCB – (California) State Water Resources Control Board
TCE – trichloroethene
TCLP – toxicity characteristic leaching procedure
TDS – total dissolved solids
tit. – title
TSD – treatment, storage, and disposal
U.S.C. – *United States Code*
VOC – volatile organic compound
WQCP – Water Quality Control Plan
WQO – water quality objective

Table 11-2
Action-Specific ARARs[a] for Selected Remedy

Action/Requirement	Citation[b]	ARAR Determination	Comments
FEDERAL			
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[c]			
On-site waste generation/Person who generates waste shall determine if that waste is a hazardous waste.	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities, such as soil cuttings from well installation and treatment residues, are hazardous will be made when the wastes are generated.
On-site waste generation/Requirements for analyzing waste to determine whether waste is hazardous.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities, such as soil cuttings from well installation and treatment residues, are hazardous will be made when the wastes are generated.
Hazardous waste accumulation/ On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads, inside buildings, is labeled and dated, etc.	Cal. Code Regs. tit. 22, § 66262.34	Applicable	Applicable for any operation where hazardous waste is generated and transported. The determination of whether wastes generated during remedial action activities, such as soil cuttings from well installation and treatment residuals, are hazardous will be made at the time the wastes are generated.
Hazardous waste accumulation/ Containers of RCRA hazardous waste must be: • maintained in good condition, • compatible with hazardous waste to be stored, and • closed during storage except to add or remove waste.	Cal. Code Regs. tit. 22, § 66264.171, 66264.172, and 66264.173	Applicable	Substantive provisions are applicable if waste is determined to be RCRA hazardous waste.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Hazardous waste accumulation/ Inspect container storage areas weekly for deterioration.	Cal. Code Regs. tit. 22, § 66264.174	Applicable	Substantive provisions are applicable if waste is determined to be RCRA hazardous waste.
Hazardous waste accumulation/ Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Cal. Code Regs. tit. 22, § 66264.175(a) and (b)	Applicable	Substantive provisions are applicable if waste is determined to be RCRA hazardous.
Site closure/At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.	Cal. Code Regs. tit. 22, § 66264.178	Applicable	Substantive provisions are applicable if waste is determined to be RCRA hazardous.
Use of tanks or piping/Requirements for secondary containment of tank systems and ancillary equipment	Cal. Code Regs. tit. 22, § 66264.193(b), (c), (d), (e), and (f)	Applicable (contingency remedy only)	Substantive provisions are applicable for groundwater treatment unit and associated transfer piping if contaminants in groundwater are determined to be hazardous.
Use of tanks or piping/Design requirements for a tank system	Cal. Code Regs. tit. 22, § 66264.192	Applicable (contingency remedy only)	Substantive provisions are applicable for groundwater treatment unit and associated transfer piping if contaminants in groundwater are determined to be hazardous.
Use of tanks or piping/Upon closure of tank system, minimize the maintenance and remove or decontaminate all contaminated equipment and materials to the extent necessary to protect human health and the environment.	Cal. Code Regs. tit. 22, § 66264.197(a)	Applicable (contingency remedy only)	Substantive provisions are applicable for groundwater treatment unit and associated transfer piping if contaminants in groundwater are determined to be hazardous.
Monitoring/Requirement for identifying chemicals of concern.	Cal. Code Regs. tit. 22, § 66264.93	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for identifying chemicals of concern for groundwater monitoring. Not applicable because Site 16 is not a regulated unit.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Monitoring/Requirements for monitoring groundwater.	Cal. Code Regs. tit. 22, § 66264.97(b), (d), and (e)(2)–(5)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring. Not applicable because Site 16 is not a regulated unit.
Monitoring/Requirements for a detection monitoring program.	Cal. Code Regs. tit. 22, § 66264.98(b), (c), (f), (g), and (i)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for establishing a groundwater detection monitoring program. Not applicable because Site 16 is not a regulated unit.
Monitoring/Requirements for an evaluation monitoring program.	Cal. Code Regs. tit. 22, § 66264.99(b), (c), (e), (f), and (g)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring. Not applicable because Site 16 is not a regulated unit.
Corrective action/The owner or operator required to take corrective action under Cal. Code Regs. tit. 22, § 66264.91 shall take corrective action to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard.	Cal. Code Regs. tit. 22, § 66264.100(b)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring and corrective action in the event of a release. Not applicable because Site 16 is not a regulated unit.
Corrective action/The owner or operator shall implement corrective action measures that ensure that chemicals of concern achieve their respective concentration limits at all monitoring points and throughout the zone affected by the release, including any portions of the affected zone that extend beyond the facility boundary, by removing the waste constituents or treating them in place. The owner or operator shall take other action to prevent noncompliance due to a continued or subsequent release including, but not limited to, source control.	Cal. Code Regs. tit. 22, § 66264.100(c)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring and corrective action. Not applicable because Site 16 is not a regulated unit.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Monitoring/The owner or operator shall establish and implement, in conjunction with the corrective-action measures, a water quality monitoring program that will demonstrate the effectiveness of the corrective action program, effectively determine compliance with the water quality protection standard, and determine the success of the corrective-action measures under subsection (c) of this section.	Cal. Code Regs. tit. 22, § 66264.100(d)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring. Not applicable because Site 16 is not a regulated unit.
Completion of response action/ Completion of the corrective action program must be demonstrated to be in compliance with the water quality protection standard based on the results of sampling and analysis for all chemicals of concern for 1 year.	Cal. Code Regs. tit. 22, § 66264.100(g)(1) and (3)	Relevant and appropriate	Substantive provisions are relevant and appropriate requirements for groundwater monitoring. Not applicable because Site 16 is not a regulated unit.
Discharge to air/Dust or fumes, including lead or lead compounds, may not be discharged to the atmosphere in amounts that exceed standards during a 1-hour period.	SCAQMD Rules 403 (approved into SIP 17 February 2000) and 405 (approved into SIP on 02 September 1998)	Applicable	Fugitive dust emissions are expected from grading and waste soil handling. Measures will be taken to control dust emissions.
Discharge to air/Particulate matter from any source may not be discharged to the atmosphere in excess of 0.1 grain per cubic foot (0.230 milligrams per cubic meter) of particulate matter in gas calculated as dry gas at standard conditions.	SCAQMD Rule 404 (approved into SIP 02 September 1998)	Applicable	Fugitive dust emissions are expected from grading and waste soil handling. Measures will be taken to control dust emissions.
Hazardous waste must be packaged in accordance with DOT regulations before transport.	Cal. Code Regs. tit. 22, § 66262.30	Applicable	Applicable for any operation where hazardous waste is generated on-site and transported. The determination of whether wastes generated during remedial activities, such as soil cuttings from well installation at treatment residues, are hazardous will be made when the wastes are generated.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Hazardous waste must be labeled in accordance with DOT regulations before transport.	Cal. Code Regs. tit. 22, § 66262.31	Applicable	Applicable for any operation where hazardous waste is generated on-site and transported. The determination of whether wastes generated during remedial activities, such as soil cutting from well installation at treatment residues, are hazardous will be made when the wastes are generated.
Provides requirements for marking hazardous waste before transport.	Cal. Code Regs. tit. 22, § 66262.32	Applicable	Applicable for any operation where hazardous waste is generated on-site and transported. The determination of whether wastes generated during remedial activities, such as soil cutting from well installation at treatment residues, are hazardous will be made when the wastes are generated.
A generator must assure that the transport vehicle is correctly placarded before transport of hazardous waste.	Cal. Code Regs. tit. 22, § 66262.33	Applicable	Applicable for any operation where hazardous waste is generated on-site and transported. The determination of whether wastes generated during remedial activities, such as soil cutting from well installation at treatment residues, are hazardous will be made when the wastes are generated.
STATE			
Monitoring/Requires semiannual monitoring.	Cal. Code Regs. tit. 27, § 20415(e)(12)(B)	Relevant and appropriate	A groundwater monitoring plan will be developed during the remedial design phase. Not applicable because Site 16 is not a regulated unit.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Land-use controls/Provides conditions under which land-use restrictions will apply to successive owners of land.	Cal. Civ. Code § 1471	Relevant and appropriate	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
Land-use controls/Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Cal. Health & Safety Code § 25202.5	Relevant and appropriate	The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . ."
Land-use controls/Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions.	Cal. Health & Safety Code § 25222.1	Relevant and appropriate	Cal. Health & Safety Code § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of Cal. Health & Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property."
Land-use controls/Provides a process for obtaining a written variance from a land-use restriction.	Cal. Health & Safety Code § 25233(c)	Relevant and appropriate	Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances based upon specified environmental and health criteria.

(table continues)

Table 11-2 (continued)

Action/Requirement	Citation[b]	ARAR Determination	Comments
Discharge to air/No person shall discharge into the atmosphere from any single source of emissions any air contaminant for more than 3 minutes in any 60-minute period that is as dark as or darker than number 1 on the Ringelmann chart.	SCAQMD Rule 401(b)(1)(A)	Applicable	Fugitive dust emissions are expected from grading and waste soil handling. Dust-suppression measures will be taken to control dust emissions.
Requirements for land-use covenants	Cal. Code Regs. tit. 22, § 67391.1	Relevant and appropriate	Cal. Code Regs. tit. 22, § 67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at the property at levels that are unsuitable for unrestricted use of the land.

Notes:

[a] many action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] only the substantive provisions of the requirements cited in this table are ARARs

[c] statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as ARARs; specific ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered ARARs

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
Cal. Civ. Code – *California Civil Code*
Cal. Code Regs. – *California Code of Regulations*
Cal. Health & Safety Code – *California Health and Safety Code*
DON – Department of the Navy
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
RCRA – Resource Conservation and Recovery Act
§ – section
SCAQMD – South Coast Air Quality Management District
SIP – State Implementation Plan
tit. – title
U.S.C. – *United States Code*

Table 11-3
Discharge Limits for Surface Water Discharge of Treated Groundwater
(units reported in micrograms per liter unless noted)

Analyte	Discharge Limits Maximum Daily Concentration Limit*
Total petroleum hydrocarbons	100.0
Benzene	1.0
Toluene	10.0
Xylene (total)	10.0
Ethylbenzene	10.0
Carbon tetrachloride	0.5
Chloroform	5.0
Dichlorobromomethane	5.0
Methyl ethyl ketone	10.0
Naphthalene	10.0
Tetrachloroethene	5.0
Trichloroethene	5.0
1,1-Dichloroethane	5.0
1,1-Dichloroethene	6.0
1,2-Dichloroethene	10.0
1,1,1-Trichlorethane	5.0
Total dissolved solids	720 mg/L
Suspended solids	75 mg/L
Sulfides	0.4 mg/L

Note:
* General Waste Discharge Requirements, Groundwater Cleanup Facilities, Order No. R8-2002-0007, NPDES No. CAG918001

Acronyms/Abbreviations:
mg/L – milligrams per liter
NPDES – National Pollutant Discharge Elimination System

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Section 12
DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Site 16 was released for public comment in September 2002. It identified Alternative 2, monitored natural attenuation with institutional controls, as the appropriate response for this site. The DON reviewed all written and verbal comments submitted during the comment period. After review of these comments, it was determined that no significant change to the response, as it was originally identified in the Proposed Plan, is necessary.

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Section 13
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RESPONSIVENESS SUMMARY

RESPONSE TO LETTERS
RECEIVED DURING THE PUBLIC COMMENT PERIOD

RESPONSIVENESS SUMMARY
MARINE CORPS AIR STATION – EL TORO, CALIFORNIA
PROPOSED PLAN, OPERABLE UNIT 3, IRP SITE 16

Letters Received During Public Comment Period

Comments by: *Mr. Larry Laven, RAB and Public Meeting Attendee per Letter Dated 3 October 2002*

Number	Comments	Responses
1	As a member of the Public, I believe I have been invited to give input, into the proposed plan for Site 16 Crash Crew training pit NO. 2, at Marine Corp. Air Station El Toro. According to the information provided in the booklet outlining the proposed plan, (at the RAB meeting September 25, 2002, page 3 & 4), an attempt to clean Site 16, has previously been made. This pilot study represents an attempt incorporated into the study which left the ground clean enough to be ignored by Alternative "3," but was unsuccessful cleaning the water. Alternative "3" is to attempt to clean the water but is not necessarily different technology from what was used in the multiphase extraction pilot study. Should these alternatives: 1, 2 & 3, be turned into a hit or miss experimental science lesson on environmental clean up, at the Navy's expense, that is not good; and for that reason I eliminate Alternative "3" from my list of choices. Alternative "2" also represents an attempt to charge the Navy for a service, theoretically previously performed, leading to the conclusion that the dirt is cleaned to the point where the return does not justify the cost, a concept relating to the Economic Law of Diminishing Returns, (please see "ECONOMICS a Text with Reading," Richard T. Gill, Second Edition, Goodyear Publishing Company, Pacific Palisades California, ISBN 0-87620-255-5 approx 1974). Glossary: Law of Diminishing Returns – In the production of any commodity, as we add more units of a variable factor of production to a fixed quantity of other factors or production, the addition to total product (the marginal product), of each added unit of the variable factor, will eventually begin to diminish. Sometimes called the Law of Diminishing productivity. The teacher's explanation was more understandable, "If you choose the best	The Navy welcomes public comment on the proposed plan for Site 16 and appreciates the time you have taken to prepare and submit this letter. The letter raises several issues, the primary one being that Alternative 1, the no action alternative, should be considered for selection for Site 16. Alternative 1, no action, is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300.430[e][6]) to be evaluated in the Feasibility Study where it serves as the baseline against which the remaining alternatives are compared. However, this alternative can only be selected if it can be demonstrated to be protective of human health and the environment. At this time, contamination at Site 16 is present in groundwater at levels that could present a risk to human health if the groundwater were extracted and used for drinking water. Because Alternative 1 does not contain any institutional controls that would prevent this use of groundwater, the alternative is not considered protective of human health. In addition, Alternative 1 contains no mechanism for verifying that the natural processes that are occurring in groundwater are successful in reducing the level of contamination. Therefore, Alternative 1 is not considered protective and cannot be selected as the final remedy to clean up the plume at Site 16. Alternative 2, Monitored Natural Attenuation, is actually very similar to Alternative 1 in that it relies on natural processes to reduce contaminant levels in the plume. The difference between Alternative 2 and Alternative 1 is the institutional controls to be implemented and that, using Alternative 2, the natural processes occurring in groundwater are monitored to assure that contaminant levels are being reduced over time to concentrations that do not pose a risk to human health and the environment. Vadose zone soil (unsaturated soil from approximately 10

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Larry Laven, RAB and Public Meeting Attendee per Letter Dated 3 October 2002		
Number	**Comments**	**Responses**
1 (cont)	apple of a bunch on your first pick, you obviously have less to choose from should you choose to take another." The real reason natural attenuation has probably been chosen is possibly because we have gotten most of what we can get buy the use of more expensive methods. In other words: The pollution that is left in the dirt after multiphase extraction, is so small that the pollution can be taken care of by nature, more efficiently than man. Option "2," (the favored plan), is to use natural attenuation to clean the ground, implying that the ground still is not perfect. Option "2" attempts to take credit for what is actually accomplished by God, or nature, and should be credited to the work of the holder of the land as nature works on the land being held now by the Navy. Natural attenuation is one of Gods gifts to man, or a gift of nature if that concept appeals better to political pressure or yourself. Why should the United States Navy pay for what the Navy is currently receiving for free? Should honesty be a goal, the Navy should select Alternative "1" amended to include institutional controls and monitoring not just the natural attenuation process, but the other factors taking place at the site as well. For example, if the water level of the plume were to rise for some unforeseen reason, the Navy obviously needs to know. Another example of a cost the Navy probably does not want to pay for is monitoring duplicating the study conducted at the "Five Year Review" I believe that the cost of a new remedy, (Actually a back up plan to Multiphase Extraction), should begin with Alternative "1" at Zero Dollars and add on to that by amending the alternative to include monitoring and institutional controls; monitoring, like the Five Year Review, and institutional controls like signs and fences.	to 160 feet below ground surface) would also be monitored to make sure contaminant concentrations are not increasing. If monitoring shows that contaminant levels are not being reduced as planned, the Navy would need to go back and evaluate possible use of another type of remedy. Five-year reviews are required by CERCLA whenever waste is left in place. The 5-year review summarizes the data collected during that period at the site and would not duplicate previous monitoring activities. This requirement is not optional at Site 16. Costs associated with Alternative 2 result from the long-term monitoring program (groundwater, vadose zone, and institutional controls), including periodic reviews. Natural attenuation itself has no cost. This comment suggests "the Navy should select Alternative 1 amended to include institutional controls and monitoring…" This is basically Alternative 2. Alternative 3, downgradient groundwater extraction and containment, was not selected because the Navy did not consider this alternative to be as cost-effective at removing the contamination present at the site as Alternative 2. However, Alternative 3 would be expected to be much more effective than the groundwater extraction system used during the pilot test study. This is because the extraction well would be placed approximately 160 feet downgradient from the source area (during the pilot test the extraction well was placed in the source area). Groundwater wells located in this downgradient area can be pumped at a much higher rate and would be expected to be much more effective at reducing contamination and preventing movement of the plume than wells located beneath the Site 16 fire-fighting pit. For this reason, should Alternative 2 not prove to be as effective in reducing contamination as the modeling shows, the Navy would consider use of Alternative 3 as a backup or contingency remedy.

(table continues)

Letters Received During Public Comment Period		
Comments by:	*Mr. Larry Laven, RAB and Public Meeting Attendee per Letter Dated 3 October 2002*	
Number	**Comments**	**Responses**
1 (cont)	The Good People of Orange County probably do not want the United States Navy to pay for an ineffective clean up, that is backed up by an insurance company called Natural Attenuation." Having been given an opportunity to visit the base, I am aware that Site 16 represents a small amount of polution, and a smaller plume of water, compared to the plume polluted by a chemical in solvent used to wash aircraft. Although I do not have a degree in science, I have still learned a little about different sciences, and am aware of the usefulness of studying a subject by first recognizing the opposites with in the subject, (the same as bar magnet, like our earth, both have opposite magnetic poles), if opposite qualities can be found in a subject, and those opposite qualities then be studied so that their characteristic extremes be understood, we create for ourselves a better understanding of the subject we propose to study. I believe that one of the reasons natural attenuation has been chosen as a remedy for Site 16, is that Site 16 has a small plume, compared to the plume contaminating both the shallow ground water and the principal aquifer, below Site "24." According to the Citizen's Guide to Natural Attenuation, under "Will natural attenuation work at every site?" the rates of the natural process are typically slow; and there fore best used when the pollution posses no threat to other areas, like (other) near by pools of water. Because Site 16 is small, and the contaminates pose no threats to near by areas, natural attenuation should be an acceptable choice, as a solution to the remaining pollutants, but should not be recognized as a success until the pollution has been destroyed, or gone away or dispersed, or been diluted down to acceptable levels. The Citizens Guide to Natural Attenuation, (by the Environmental Protection Agency), points out that by the time a particular plume,	You are correct in pointing out that one factor considered by the Navy in selecting natural attenuation was that groundwater at Site 16 should not impact other areas. Specifically, the contamination at Site 16 is limited to shallow groundwater and should not impact portions of the deeper aquifer that could potentially be used for drinking water purposes.

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Larry Laven, RAB and Public Meeting Attendee per Letter Dated 3 October 2002		
Number	**Comments**	**Responses**
1 (cont)	(I believe polluted with the same pollutant at Site 16, TCE), by the time that plume, originating inland at St. Joseph Michigan, had reached the Great Lakes a distance away, and studied twenty years after the initial action causing the need for a correction, the plume had been found to have one thousand times less TCE at the Great Lakes than the plume had when it originated. The Environmental Protection Agency, credits micro-organisms with killing the pollution, however I would like to know "How do they know that the lower level is not the result of the pollutant being absorbed into the land between St. Joseph Michigan and Lake Michigan?" The Citizen's Guide to Natural Attenuation, is partly hypocritical, the Environmental Protection Agency, tries to build a case on behalf of natural attenuation cleaning water, but then under "Will natural attenuation work at every sight," the Citizen's guide states at the end that certain geological formations, like fractured bedrock aquifers or lime stone areas, are less likely qualifiers for natural attenuation because these environments often have a wide variety of soil types that cause an unpredictable ground water flow, and making the movement of the contamination difficult. I can't help asking myself if the movement of water also prevents the pollutant from settling to the bottom, and coming into contact with (organic) matter that absorbs the pollutant, and then hopefully break up. I favor the science of natural attenuation, however I am against paying for God's work, and ask the El Toro Restoration board to choose option "1" amended to include monitoring and institutional controls like signs and fences needed to protect the public while natural attenuation takes place. I also ask the restoration board to consider the need to be careful with Site "16" so that Site 16 can be used as a laboratory to study the natural attenuation process and used as the criteria to judge other accomplishments against, keeping in mind that natural attenuation is one of the least expensive clean up method and in fact does take place even if not attempted or paid for. Truly, when paying for the minimum natural	

(table continues)

Letters Received During Public Comment Period		
Comments by: *Mr. Larry Laven, RAB and Public Meeting Attendee per Letter Dated 3 October 2002*		
Number	**Comments**	**Responses**
1 (cont)	attenuation service, the customer pays for the institutional controls, and not the actual act of cleaning the ground. When you think about it shouldn't the land holder be given credit for the natural attenuation taking place on the land? I ask that El Toro Restoration Advisory Board, to recognize that on the cost curve, Natural Attenuation represents not just the low end, but the extreme low end or bottom of the Cost Curve. Alternative "1" amended to include monitoring and institutional controls is a better deal for the navy because Alternative "1" is more honest about what is being delivered as a benefit.	
Comments by: *Mr. Daniel Jung, Director of Strategic Programs, City of Irvine, Letter Dated 15 October 2002*		
2a	Thank you for the opportunity to comment on the Proposed Plan for addressing the Site 16 groundwater contamination at Marine Corps Air Station El Toro. We understand the plan calls for the use of monitored natural attenuation with institutional controls to remediate the TCE in the groundwater and to establish a backup plan involving down-gradient groundwater extraction and containment if natural attenuation fails to remediate the contamination as expected. Further, we understand that groundwater extraction is difficult at this particular site and that dilution to below maximum contamination levels (MCLs) is expected to occur over time. While the City of Irvine does not object in principle to the use of natural attenuation, we believe there are a number of outstanding issues that should be resolved prior to adoption of the proposed plan. If these issues cannot be addressed satisfactorily, we believe that the Navy should adopt the backup remedy as its primary plan for the site. 1. It appears that groundwater flows need further characterization. Given that the plume appears stable, groundwater flow may be minimal or	At this time, monitored natural attenuation (MNA) has been selected as the most appropriate remedy for groundwater at Site 16. This selection was made for several reasons, including the difficulty of extraction that is mentioned in this comment and the lower impact MNA would have on reuse of the site. The effectiveness of this remedy will be evaluated throughout the remedial action phase to assure that the remedy continues to adequately protect human health and the environment and is achieving cleanup goals. If, during the 5-year review or at any other time during the implementation of MNA, it is determined that the remedial action objectives are not being met, the Department of the Navy will evaluate whether potential new technologies could be effective or whether the contingency remedy should be implemented. Criteria for evaluating the success of MNA are provided in the Site 16 Record of Decision (ROD). Per the ROD, any of the following criteria would trigger the need to evaluate whether implementation of the contingency remedy is appropriate (determination will be made in consultation with the Base Realignment and Closure Cleanup Team):

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Daniel Jung, Director of Strategic Programs, City of Irvine, Letter Dated 15 October 2002		
Number	**Comments**	**Responses**
2a (cont)	variable depending on seasonal precipitation. This suggests that the dilution rate may be difficult to predict. We are concerned that the estimate of 19 years for complete cleanup may not be bounded by a high degree of confidence and could be substantially longer. We assume that there is greater certainty around the expected completion time for the active extraction alternative (9 years). If, after characterization of the groundwater, the proposed alternative is substantially longer (e.g., 2x or more) than the original estimate, we suggest reviewing the alternatives to determine if the preferred remedy is still the most protective of public health and safety.	• VOC groundwater concentration data indicate that after 10 years VOCs have extended or will likely extend farther downgradient than the 1,300 feet from the main pit predicted by the groundwater model. • VOC groundwater concentration data in the main pit area indicate an increasing trend, suggesting additional containment of the VOC plume is necessary. • The trend of VOC concentrations in groundwater in the main pit area indicates that natural attenuation will not meet the remedial action objectives in the 19-year time span predicted by the groundwater model. It should be noted that the same model and inputs were used to estimate the cleanup time for both Alternatives 2 and 3. Therefore, any uncertainty in cleanup times would apply similarly to both alternatives.
2b	2. We believe that the remediation plan should specify specific milestones including rates of dilution over time that the preferred alternative should meet. Further, the plan should specify what will happen if the milestones are not met and the specific conditions under which the backup remedy would be implemented. The City would prefer to avoid additional studies and investigations if the milestones are not met.	Please see the response to Comment 2a. The performance of the MNA remedy will be compared with modeling results predicting the extent of plume migration and the decline in TCE concentrations over time (e.g., Figures 3-2 and 3-3 in the Site 16 Focused Feasibility Study). If this comparison shows that the plume is migrating further downgradient than predicted or the concentrations of TCE are not declining over time as predicted, use of the contingency remedy will be evaluated. The contingency remedy is included in the ROD since the Site 16 Focused Feasibility Study already evaluated this alternative as a viable option for the site. If implementation of the contingency remedy were required in the future, minimum investigations (i.e., remedial design) would be necessary.
2c	3. The City of Irvine has been working closely with Department of the Navy representatives on a reuse plan that is consistent with Measure W approved by Orange County voters. Site 16 is within an area zoned for	The Department of the Navy is aware of the current proposed reuse plans for Site 16 and believes that the selected alternative is most compatible with this reuse.

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Daniel Jung, Director of Strategic Programs, City of Irvine, Letter Dated 15 October 2002		
Number	**Comments**	**Responses**
2c (cont)	passive park use and a riparian corridor. Current plans call for a meadow to encompass the Site 16 area. The City has several questions about the preferred alternative and its consistency with the reuse plan. These include: a. How will the City's reuse plan affect the proposed remediation strategy? b. Would grading be allowed at the site? c. How would landscaping and irrigation affect the remediation strategy, assuming a meadow with grasses, trees, and shrubs? d. What are the specific locations of current and proposed monitoring wells? e. What kind of protection will be required for the wells (e.g., covers and locks, fences, etc.) and will there be requirements to keep public access a minimum distance from the wells? f. What kind of access by the Navy and regulatory agencies will be required for the preferred alternative; will provision of access for drill rigs be required into the future? g. What kind of access, institutional controls, etc, would be required for the backup plan if implemented? h. What specific institutional controls will be required for the site? i. Current City policy calls for the use of Integrated Pest Management for City properties; will the use of typical landscape management practices (pesticides, fertilizers, etc.) be consistent with the preferred alternative?	a. The selected alternative considers the proposed reuse of Site 16 as a park. This use will not interfere with the proposed remediation strategy. b. Grading would be allowed at the site as long as positive drainage is maintained over the main pit. Positive drainage will reduce the amount of infiltration into soil at this location and minimize the potential for further impacts to groundwater. c. Because of positive drainage in the area, landscaping as described in this comment and typical irrigation practices that would not include large application of water are not expected to adversely affect the remediation strategy and would not be prohibited. d. The locations of the current and proposed monitoring wells are shown on Figure 3-4 of the Site 16 final Focused Feasibility Study Report. The actual location will be determined during the remedial design phase. The City of Irvine will be included on the distribution of the remedial design packages. e. The wells will be covered and secured. The actual mechanism by which the wells will be secured will be addressed during remedial design. Fences are not expected to be used and it is not anticipated that there will be any requirements to keep public access a minimum distance from the wells. Monitoring of wells within public facilities has been conducted at other closed bases with beneficial reuse (e.g., golf course at Norton Air Force Base). f. The Department of the Navy and regulatory agencies will require access to the monitoring wells so that the wells can be sampled and maintained. Since the remedy contains provisions for a possible additional downgradient monitoring well, access would be required to install a well if it is needed in the future. Access will also be required to implement additional remedial action if

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Daniel Jung, Director of Strategic Programs, City of Irvine, Letter Dated 15 October 2002		
Number	**Comments**	**Responses**
2c (cont)		the selected remedy is not found to be effective. The additional monitoring well or remedial action could necessitate use of drill rigs and/or treatment equipment. In addition, sufficient area to utilize a drill rig to abandon any monitoring or extraction wells upon completion of the remedial action may be needed. The space requirements for a drill rig should be considered during development of a reuse plan. A typical drill rig is approximately 10 feet wide by 35 feet long and can only be used if no overhead utilities are present. The location of any remediation equipment that could be required in such a case would be determined with input from the property transferee. g. The contingency remedy includes extraction of groundwater from existing well 16GE1 (shown on Figure 3-9 of the final Site 16 FFS), treatment of the groundwater, and discharge to a nearby storm drain. If the contingency remedy were to be implemented, fencing would be used to limit access to any active remediation equipment (groundwater pump and treat system) installed at the surface and protect the public from potential exposure to contaminated groundwater. h. The following land-use restrictions on property overlying the Site 16 shallow groundwater plume are taken from the Site 16 ROD: 1. No new wells of any type shall be installed within the Site 16 shallow groundwater plume or associated buffer zone without prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB. The transferee/lessee shall also obtain permits for such wells as required. 2. Monitoring wells and associated equipment that are included in the alternative shall not be altered, disturbed, or removed without the prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB. 3. Positive drainage shall be maintained over the main pit area of Site 16 to minimize infiltration into soil at this location. 4. The DON, U.S. EPA, DTSC, RWQCB, and their authorized agents, employees, contractors, and subcontractors shall

(table continues)

Letters Received During Public Comment Period		
Comments by: Mr. Daniel Jung, Director of Strategic Programs, City of Irvine, Letter Dated 15 October 2002		
Number	**Comments**	**Responses**
2c (cont)		have the right to enter upon the premises to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain the remedial action described in this ROD or undertake any other remedial response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells and to extraction wells and treatment equipment should more active remediation be required in the future. i. Use of typical landscape management practices would be consistent with the preferred alternative and would not be prohibited.

RESPONSE TO COMMENTS
RECEIVED DURING THE PUBLIC MEETING

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: ***Ms. Linda Grau, RAB and Public Meeting Attendee and Candidate for Irvine City Council***		
Number	**Comments**	**Responses**
1	You have mentioned, the group of you, different aspects of the Base that need cleanup. One of them is the depression where the firefighters used fuel and water. And then, in some of the reading material, I saw here there was ordnance that needed to be cleaned up. I imagine that would be leftover bombs, and bullets, and that kind of thing. And then, something else was mentioned about petroleum with a different program. Is all that you're doing here just for the depression that had the firefighters working in it, or is it comprehensive of all the programs?	The Navy's Installation Restoration Program addresses various types of contamination at areas throughout the entire Station. However, the subject of the public meeting held on 25 September 2002 was contamination due to volatile organic compounds at only one area, Site 16. Site 16 was used by the former MCAS El Toro crash crew between 1972 and 1985 as a training area for firefighters. Other sites at the base are at varying stages within the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process and have had or will have their own site-specific investigations and public meetings. Petroleum contamination remaining at Site 16 as a result of firefighter training activities will be addressed through the Petroleum Corrective Action Program.
Comments by: ***Mr. Don Zweifel, RAB Member***		
2a	Well, you all know how I stand. Well, you know, when Joseph Joyce was, you know, the BRAC Environmental Coordinator, he said Don, I've just been to a special presentation, a symposium down in Texas, I believe it was – And maybe you guys went, too – on natural attenuation. He said it's the best thing since sliced bread. Of course, on the prima facie, on the surface of it, it seems well, maybe it is a good idea. But the thing is, then, we look at another factor. We always have wanted, from the get-go – at least, I have; and I think others in this room, maybe – clean closure. But it's something that the Navy – the Department of the Navy may not want to hear. But then, you know, you guys are regulators. And I know I'm asking a lot. We're asking a lot. But the question is, you know, consider clean closure. And I know that that sounds like, you know, costly. However, you know, there are ways to expedite these matters.	Clean closure of an area occurs when materials that could pose a risk to human health or the environment are removed so that no restrictions on future use are required for the site. For example, at a landfill, clean closure could occur if all wastes were excavated and removed from the site. Attempts to evaluate a technology to remove the contamination in groundwater at the source area were conducted during the MPE pilot study. The results indicated the technology was not effective in cleaning up the contamination in groundwater and other cleanup approaches would be difficult to implement based on site conditions. Site 16 is not a landfill site and the contamination that is present at Site 16 is largely present in groundwater. Therefore, this question does not appear to be specifically related to Site 16. The remedial action objectives (RAOs) for Site 16 include cleaning groundwater to a residential reuse scenario. The risk exposure scenario used for groundwater included children and adults that were assumed to use the water for domestic purposes from a private well screened in the

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: *Mr. Don Zweifel, RAB Member*		
Number	**Comments**	**Responses**
2a (cont)	For instance, the – As far as the landfills are concerned, we could have excavated these landfills. And then – I just wanted to give input. I want to know why we couldn't have excavated, you know, the landfills. Let me know. Chuck did say that he felt that some of the landfills would be more cost-effective. The cost benefit ratio would be higher if we just excavated it, maybe process it on-site. The question is: What do you think about clean closure?	shallow aquifer, within the plume, beneath Site 16. The modeling indicates that when treatment is complete at the end of the remediation process, concentrations of TCE in groundwater will be at or below drinking water standards. At this point, all restrictions would be removed.
2b	Well, you know, let's look at Alternative 3, for goodness sake, regulators. Please, consider this. Let's look at this real quick. It looks like Alternative 3, downgradient extraction, would be a better idea. And the reason why I'm saying this is because – well, I mean, the idea is we don't want to wait forever. And it seems like this would be a more expeditious way of remediating the problem. So let's think about it for a moment.	Alternative 3 was not chosen as the preferred remedy because it was not considered to be cost-effective. It was also more difficult to implement than Alternative 2 and was expected to have more impact on reuse of the site. The most highly contaminated portions of the VOC plume are in areas where the properties of the aquifer make groundwater very difficult to extract (i.e., the pumping rate and radius of influence of the wells are both very low). This is why the multiphase extraction pilot test conducted at Site 16 was not effective at removing contamination from groundwater. Placing the extraction well downgradient of the plume in a less highly contaminated area (as Alternative 3 does) would allow more groundwater to be extracted, but because the well is in a less contaminated area of the aquifer, it would still require approximately 9 years (assuming that the alternative was as effective as the model showed) to reach drinking water standards. Although Alternative 2 takes longer to achieve cleanup goals (19 years versus 9 years), this is considered a reasonable time frame by both the Navy and the regulatory agencies. In addition, Alternative 2 poses less short-term exposure to workers and is easier to implement than Alternative 3. Both Alternatives 2 and 3 would protect human health through deed restrictions prohibiting use of contaminated groundwater. In the case of Alternative 2, these controls would be in effect for a longer period of time than they would for Alternative 3 because cleanup would take longer. This is not expected to be a problem because groundwater in the shallow

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by:	***Mr. Don Zweifel, RAB Member***	
Number	**Comments**	**Responses**
2b (cont)		aquifer is not used for drinking water purposes and is unlikely to be used for those purposes in the future due to high total dissolved solids and nitrate concentrations. Since the deed restrictions are expected to effectively protect human health or the environment while the remedy is being implemented, time to reach cleanup goals was not the driving factor in selection of the remedy.
2c	However, there is a problem. And we have a problem. And that problem is we have the groundwater subbasin is being depleted. What I'm referring to is recharge. We have to recharge the groundwater basin. And here, the question is – you may not think it's important, but it is important. We've just – The Orange County Water District just determined that our groundwater subbasin is in dire straits. We've been depleting it. And so, the question is whether this would impact detrimentally the – well, the drought – I mean, will it affect the drawdown? And if it will affect the drawdown, to what extent? Will it augment the drawdown? If it does, we've got a problem here. We need our groundwater. Will it be depleted to the point where it can't – It's the permeability factor? Right? We've talked about that. Once those clay layers have been – once you've extracted the moisture from those clay layers, then they lose their permeability forever.	The preferred remedy, monitored natural attenuation, will not impact recharge or drawdown because it does not employ extraction wells, which would remove groundwater from the aquifer. Alternative 3, which is the remedy recommended in this comment, does employ extraction wells and would, therefore, be much more likely to affect drawdown than Alternative 2.
Comments by:	***Mr. Jerry Werner, RAB Member***	
3	As I was talking with Marc before the meeting, what does the curve of concentration versus time look like for natural attenuation in terms of your Table 4 which you have your data? When was that data taken?	This comment refers to Table 4 in the Site 16 Proposed Plan. Table 4 compares U.S. EPA and state of California drinking water standards with the maximum concentrations of VOCs commonly reported at Site 16. Maximum concentrations were taken from groundwater investigations summarized in the Site 16 final focused feasibility study. Of the nine VOCs listed in Table 4, trichloroethene (TCE) is the primary risk driver and the only chemical that has exceeded drinking water standards consistently over time. Groundwater modeling was performed during the focused feasibility study to predict how long it would take for each of the alternatives to

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: *Mr. Jerry Werner, RAB Member*		
Number	**Comments**	**Responses**
3 (cont)		reduce concentrations of TCE to drinking water standards. Monitored natural attenuation (Alternative 2) is expected to reduce the concentration of TCE to 5 micrograms per liter or less within approximately 19 years. This information is provided on Table 5 of the Site 16 Proposed Plan under the column titled "Years to Complete Cleanup." A graphical representation of the decline in TCE concentrations over time due to natural attenuation of TCE in groundwater at Site 16 is presented in Figure 3-3 of the final Focused Feasibility Study for Site 16. This figure presents a plot of the output data of the predicted decline in TCE concentrations over time based on the results of groundwater modeling. The modeling was performed using commercial computer codes MODFLOW and MT3D with input of specific data from Site 16.
Comments by: *Mr. Rob Mead, RAB and Public Meeting Attendee*		
4	Related with Site 16, you mentioned in here that the VOCs were removed down to a depth of a hundred and sixty feet, I believe was the depth that was given. How exactly were those removed?	Between October 2000 and April 2001, the Navy conducted a pilot test of a technology called multiphase extraction (MPE) at Site 16. MPE is designed to simultaneously remove VOCs from soil and groundwater and is one of the U.S. EPA's presumptive or preferred remedies for sites with VOC contamination in both soil and groundwater. (Presumptive remedies use technologies that have been shown to be effective at sites that have similar characteristics, such as types of contaminants.) One hundred sixty feet is the approximate depth to groundwater at Site 16. When it was mentioned that VOCs were removed to a depth of 160 feet, the statement was alluding to the fact that MPE was very successful in removing VOCs from the vadose zone (unsaturated soil from approximately 10 to 160 feet below ground surface). However, the MPE technology was not effective in removing VOCs from groundwater present below 160 feet. The MPE technology uses an extraction well to pump groundwater to the surface, where it is treated. In addition, a vacuum is applied to the well to pull VOCs present in soil as a vapor phase to the surface where they can be treated. In addition, the vacuum applied increases the water yield of the well, thereby increasing recovery of VOCs dissolved in groundwater.

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: ***Mr. Larry Laven, RAB and Public Meeting Attendee***		
Number	**Comments**	**Responses**
5a	I was just curious as to TCE. I'm not really a chemist. There's a lot of complicated – Is that the same chemical that's in the groundwater plume that they're going to use vapor extraction? This is a little contaminated site – Right? – compared to where they were washing the airplanes by the hangar? Is that the same chemical in the water, both places?	Trichloroethene (TCE) is a chemical of concern at several sites at MCAS El Toro, including Site 24 (the site containing two large aircraft hangars). TCE is also present at Site 18 in the form of a large groundwater plume that extends approximately 3 miles off-Station. Soil vapor extraction was the remedy selected for removal of VOCs from soil at Site 24. This remedy has been implemented and soil at this site is now recommended for closure. Groundwater at Sites 18 and 24 will be remediated using extraction and treatment (pump and treat) in a joint project being conducted by Orange County Water District and Irvine Ranch Water District in conjunction with the Navy. The volume of TCE-contaminated groundwater at Site 16 is much less than at Sites 18 and 24 and does not extend into the principal aquifer, which is a potential drinking water supply source.
5b	I just have a comment on this, though. From looking at this, I get the idea that this is a very small area, and that the – I also saw this when we drove by. And the plume, I have a feeling, is small underneath it and not really going anywhere. And, scientifically, I have learned to study things from extreme angles fist. You look at something at one angle of an extreme, and then you take something out at another angle. This is small. And to see what natural attenuation would do, you might as well try it here, where you could do something. Because on a grander scale, yeah, where are you going to compare it to, where you can set up this stuff and do all kinds of stuff; right? What could you compare it to where you had done less to see what the difference is? It might be interesting, you know, something to compare a different, you know, natural attenuation. Like, yeah, he's concerned about clean closure. But what if all this stuff doesn't work for something we don't see in the end, anyways?	As noted in the last response, the plume at Site 16 is very limited in extent, especially when compared to the plume at Site 18 and Site 24. It is also not moving rapidly. In the past 17 years since fire-fighting exercises were discontinued at this site, the plume has moved approximately 300 feet. The small mass of contamination present coupled with the type of soil beneath the site (which holds the TCE in place and makes it difficult to remove) make the groundwater plume a good candidate for natural attenuation.

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by:	*Dr. Michael Brown, Consultant for City of Irvine*	
Number	**Comments**	**Responses**
6a	First, the City is working with the Navy to develop a Reuse Plan. That assumes that excepting the landfills, there will be unrestricted use of all the surface property. And will that also be the case at Site 16? You mentioned institutional controls specifically around areas of groundwater. But will there also be institutional controls specifically restricting any surface activities on the site? And that also – Related to that is if there is in reuse, which is that particular area's current configuration, the Reuse Plan contemplated to be – I'll say a general open space, is any grading – would any grading be allowed at that site, either additional soil or any soil removal? So that's one issue.	The city of Irvine's current use plan calls for reuse of Site 16 as recreational (park). Institutional controls for Site 16 are compatible with this proposed reuse as discussed below. Institutional controls in the form of land-use restrictions will be used to limit the exposure of future landowner(s) and/or user(s) of contaminated groundwater underlying the property and to maintain the integrity of the remedial action until remediation is complete and federal and state cleanup levels have been met. The following are land-use restrictions on property overlying the Site 16 shallow groundwater plume. 1. No new wells of any type shall be installed within the Site 16 shallow groundwater plume and associated buffer zone without prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB. The transferee/lessee shall also obtain permits for such wells as required. 2. Monitoring wells and associated equipment that are included in the alternative shall not be altered, disturbed, or removed without the prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB. 3. Positive drainage shall be maintained over the main pit area of Site 16 to minimize infiltration into soil at this location. 4. The DON, U.S. EPA, DTSC, RWQCB, and their authorized agents, employees, contractors, and subcontractors shall have the right to enter upon the premises to conduct investigations, tests, or surveys; inspect field activities; or construct any other remedial response or remedial action described in the FFS or undertake any other remedial response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, and treatment facilities.

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: Dr. Michael Brown, Consultant for City of Irvine		
Number	**Comments**	**Responses**
6a (cont)		These restrictions would not restrict surface activities as long as the surface activities do not disturb the monitoring wells or prevent the DON or regulatory agencies from accessing the site. Grading would be allowable as long as monitoring wells are not disturbed and a positive drainage is maintained over the main pit area. The institutional controls will be removed once groundwater cleanup is complete.
6b	Second issue is what kind of restrictions are being contemplated for protection of the monitoring wells? How many monitoring wells are being contemplated?	Institutional controls to protect wells are listed in the above response. During the FS it was estimated that groundwater would be monitored using seven existing monitoring wells located upgradient, crossgradient, and downgradient of the Site 16 source area. The exact number of monitoring wells will be determined during the design phase. The city of Irvine will be included on the distribution of the remedial design packages.
6c	What kind of access will the Navy and regulatory agencies need, both in terms of physical access and any contemplation of barriers that need to be a certain distance via any kind of construction or landscaping? If that particular area were to be landscaped and irrigated, is that a problem, from your perspective?	The Navy and regulatory agencies will require physical access to the groundwater monitoring wells that are part of this remedy. In addition, the Navy will require access to the entire site in case the selected remedy is not effective and an alternative remedy is required. Sufficient area to utilize a drill rig to abandon any monitoring or extraction wells upon completion of the remedial action may be needed. The space requirements for a drill rig should be considered during development of a reuse plan. A typical drill rig is approximately 10 feet wide by 35 feet long and can only be used if no overhead utilities are present. Landscaping and irrigation would not be a problem as long as a positive drainage slope is maintained over the main pit and excessive amounts of water are not used.
6d	Also related to Mr. Werner's question about the attenuation curve, if using natural attenuation, if this is a case of basically letting dilution bring levels of TCE below the MCL, what is the dilution rate? Because it's not in the Proposed Plan. And can you explain for us if that rate is – that dilution rate is not being met, is that what is going to trigger the use of the contingency alternative? Or what exactly will trigger the use of the contingency alternative?	Please see the response to Comment 3. The natural attenuation process at Site 16 was modeled using the commercial computer codes MODFLOW and MT3D, which account for the site-specific effects of degradation, dilution, dispersion, and sorption of contaminants. Biodegradation and biological or chemical transformation processes were not considered to be significant factors in natural attenuation at this site because the typical breakdown products DCE and vinyl chloride that would occur via these processes were infrequently reported above detection limits. No specific dilution rate was input into the models. The dilution component that

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: *Dr. Michael Brown, Consultant for City of Irvine*		
Number	**Comments**	**Responses**
6d (cont)		contributes to the TCE reduction is largely dependent on the groundwater flow velocities, which are internally calculated by the MODFLOW model based on site-specific input data. The predicted reduction in TCE concentration over time is shown on Figure 3-3 of the Site 16 FFS. Any of the following criteria would trigger the need to evaluate whether the implementation of the contingency remedy is appropriate: • VOC groundwater concentration data indicate that after 10 years VOCs have extended or will likely extend farther downgradient than the 1,300 feet from the main pit predicted by the groundwater model. • VOC groundwater concentration data in the main pit area indicate an increasing trend, suggesting additional containment of the VOC plume is necessary. • The trend of VOC concentrations in groundwater in the main pit area indicates that natural attenuation will not meet the remedial action objectives in the 19-year time span predicted by the groundwater model.
6e	And then, are there any other – If the alternative is implemented, what kind of institutional controls will be associated with that? Will there be additional restrictions on surface uses because of the existence of a pump and treat activity?	Institutional controls for Alternative 3 would be similar to those for Alternative 2. In addition to monitoring wells, disturbance of the extraction wells or their associated piping or treatment equipment would be prohibited.

(table continues)

Comments Received During Public Meeting Held on 25 September 2002		
Comments by: *Mr. Bill Preston, RAB and Public Meeting Attendee Representing Pres-Tec*		
Number	**Comments**	**Responses**
7	My understanding of the two alternatives that have been selected is that the preferred one would cost two million dollars and take nineteen years in the process. The backup plan, I don't really know what the time line says that would take, but it would cost three million dollars. The question is: If there were a proven technology available, new technology, is there a process, a speed-up process, that they can go through that would evaluate and either pass or fail that new technology within a period of time that could, you know, make it still be evaluated here? And just as an aside, the new technology in this case, I believe, could completely clean up that TCE spill within a year and at a cost of less than a million dollars. So is that of interest to the Navy, to the City of Irvine, to the various regulatory agencies, et cetera, et cetera? Is that of interest to pursue that? Possibly taking a little more time in making the final decision, but also possibly saving a million dollars and, ultimately, maybe as much as eighteen years in the cleanup process.	The Navy performed an extensive review of a variety of technologies for remediation of TCE-contaminated groundwater at Site 16 in the focused feasibility study taking into consideration site-specific activities. As a result of that review, several innovative technologies were eliminated because they are not effective at sites where organic compounds are present at too low a concentration to support bioremediation, or the technologies were not proven to demonstrate that cleanup goals could be achieved. Based on the results of the focused feasibility study, Alternative 2 was chosen as the preferred remedy because it would protect human health and the environment through deed restrictions prohibiting the use of contaminated groundwater and provide for tracking of plume attenuation via monitoring, and because it represents the most cost-effective remedy that is protective of human health and the environment. Long-term monitoring and 5-year reviews will be used to evaluate the effectiveness of the selected remedy. If the 5-year review indicates that the remedy is not protective of human health or is not performing as designed, the 5-year review report would make recommendations to improve performance. This could include a recommendation to evaluate alternative technologies that have proved to be successful at sites that are similar to Site 16.

ATTACHMENT A

SITE-SPECIFIC ADMINISTRATIVE RECORD INDEX FOR OU-3 SITE 16

UNSCANNABLE MEDIA

To use the unscannable media document # 2249416
contact the Region IX Superfund Records Center

ATTACHMENT B

TRANSCRIPT FROM PUBLIC MEETING

MARINE CORPS AIR STATION EL TORO

PROPOSED PLAN PUBLIC MEETING

OPERABLE UNIT 3, SITE 16

CERTIFIED COPY

FORMAL PRESENTATION/PUBLIC COMMENT

Wednesday, September 25, 2002

6:30 p.m.

Irvine City Hall
One Civic Center Plaza
Conference and Training Center
Irvine, California

Reported By: Jeanine Burgner, CSR No. 6653

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* * *

Wednesday, September 25, 2002

* * *

(The following comments were made on the record:)

MR. DEAN GOULD: Okay, folks. If you wouldn't mind taking seats, please, preferably toward the front, if you don't mind. But it's a small enough room where you sit wherever you feel comfortable.

Welcome everybody, and thank you very much for coming out this evening. I know this is a challenging time for folks to get out. It's fairly early in the evening, so it may have conflicted with personal schedules, as well as dinnertime. I see the cookies are getting hit pretty hard back there. We do sincerely appreciate your coming out.

I will give you a briefing on the format of this evening. And we'll get into an actual presentation portion. A couple introductions first, before we get started. Some of the key players:

You'll notice to my right, we have Jeanine Burgner; and she is the Court Reporter, fulfilling that function for us to tonight, so we can keep as accurate a record tonight of questions and answers that take place, so we can have a permanent, official record, so we can better respond to you and whatever questions you may have for us tonight.

Also to my left, we have Mr. Marc Smits. He's the Navy RPM who has been the lead for this site.

And I'll let the regulatory agencies introduce themselves.

MS. NICOLE MOUTOUX: Hi, my name's Nicole Moutoux.

MS. TRISS CHESNEY: My name's Triss Chesney, and I work for the Department of Toxic Substances Control.

MR. JOHN SCHOLFIELD: Oh, and I'm John Scholfield. And I work for Brown and Caldwell. And I've been the Project Manager on Site 16 since 1995.

MR. DEAN GOULD: So John is a contractor hired by the Navy. And as he mentioned, he's been the lead for us on the site.

One regulatory agency representative that wasn't able to make it this evening did ask for me to pass on his regrets. He's assigned to covering two bases, and he had a schedule conflict tonight. And that would be Mr. John Broderick of the Regional Water Quality Control Board. So a key player, to be sure, but we can pass along his contact information should you care to ask information of him or pose questions to him concerning anything you hear here tonight.

JERRY WERNER: Has he taken over for Pat Hannon?

MR. DEAN GOULD: Jerry Werner asked has John Broderick stepped in, in the place of Patricia Hannon at the Regional Water Quality Control Board. And the answer is yes. She's on maternity leave at this time, so he will he be filling in for her for some period of time.

I mentioned we're going to cover the format this evening. We're actually one-third of the way through, even though it may seem like we're just getting starting.

The format this evening is a hybrid of formats. We have a poster-board layout tonight, which a lot of people appreciate. Both regulatory agencies and contract experts are here for you to pose questions to them one-on-one and get answers and immediate feedback. So we do that up-front, to have you ask questions in that manner.

Now, we're going into the second of three phases. And that is where we're going to give a somewhat formal presentation to you. I say "we," the Navy is complimented by the regulatory agencies on the site, its history, background the development of it from a remedial, or a remedy, perspective and, ultimately, the selection of an alternative.

And then, the last portion would be more open time at the end for you to speak either with us or pose questions to the Court Reporter.

Right now, we're not quite halfway through a very critical phase in this time line. This is the Public Comment Period that started September 17th and that will go thirty days, till October 17th. I say it's critical because we're at a crossroads right now. "We," the BCT or BRAC Cleanup Team comprised of the Navy and regulatory agencies and our contractor representatives. We've done a lot of work over a number of years.

Mr. Scholfield has mentioned how long he's been on the project. We've done a lot of research. We've done a lot of studies. We've done a lot of pilot tests. And we have identified alternatives, but we're at the point of selecting an alternative. But I mentioned we are at a crossroads.

There has been public participation throughout the process up to this point in the way of reviewing our documents, and what have you. But now, this is our official offering to the public, essentially to get a public vote of confidence in the alternative that we've selected -- "we," the BCT -- that we are heading down the right road and that you feel comfortable that the remedy we've selected is truly going to be protective of the human health and environment. So your attendance here and your participation is really quite critical.

And I do appreciate you coming here, sincerely, because you -- As a community member, you are playing a truly vital role. So thank you, again, for coming.

As far as comments go, I was thinking about this just a little bit ago. I can think of at least five opportunities that you'll have to provide feedback to us:

The first was during this poster-board session.

A second would be towards the end of this formal presentation, you'll have an opportunity to stand and voice questions or comments that will be officially recorded.

A third would be afterwards, you can go and sit privately with the Court Reporter and have your comments entered that way.

A fourth would be -- You can see the box right there to my right, your left -- submit written comments here, and go ahead and just jot them down.

And a fifth, I mentioned that the Public

Comment Period goes up to the 17th of October. You have up until then. If tonight you're chewing on some issues or you want to do a little more research, you have up till then to take all the documentation, format your question. And if you come up with any issues you want to bring up to the Navy or the regulatory agency's attention, it can be done electronically, by fax, as long as we get it by the 17th, so we can keep the process moving.

So there's five different ways for you to provide input to us. So, please, do that. You came here tonight. Now, we need to get some feedback from you as to your thoughts, where you're at in the program.

The next phase we're going to get into now, as I mentioned, the formal presentation portion. I'm going to ask if you can hold your comments till the end, and we can proceed. We have about twenty-five, or so, slides that we're going to go through. We, in all likelihood, will not be able to respond to your questions. What we do, typically, in these types of formats, we take the comments back. And we want to develop a detailed written response to you. We have your questions in writing, and we'll respond in writing so you have a detailed response, to make sure we get that to you, to your personal address, in a timely manner.

Hopefully, everybody -- as we go along, it would be good for you to have a copy not only of the Proposed Plan itself, but also of the -- a copy of the slides that we're going to be walking through, so you can take notes as we go along.

MR. ROBERT COLEMAN: If you need one, I'll get you some.

MR. DEAN GOULD: Yeah, we can get those for you. Okay.

As I mentioned, once we complete this presentation portion, I'll invite you to stand and voice questions for recording. When those are concluded, then we'll stop that portion of the meeting. And then, we'll go into that third phase, where you can speak one on one either with the Reporter or with any of the representatives that are here. We may be able to answer some questions if they're of an administrative nature, times, dates, things like that. But technical issues, those are the ones we'll probably be responding to in writing. So thank you, again, for coming this evening. We'll go ahead and move on with the presentation.

You can see the three phases there. I've covered most of this already. Tonight, we're going to walk through the various phases that we've spent a number of years now developing, analyzing and critiquing, and then finally summarizing with a preferred alternative. You can see we're going to talk about the contamination that was identified at the site, the alternatives that were developed and analyzed. And then, it says Marine Corps. The Navy is doing this on behalf of the Marine Corps, our selection of a preferred alternative. And then, we'll talk a little bit about the BCT's involvement as a whole.

Boy, it seems like we've been working on this a long time. Why does it take so darn long?

Well, this is also on the poster board over there, but you should be able to refer to this.

You can see in 1990, MCAS El Toro was identified as an NPL site, based on the National Priorities List. Why?

Primarily as a result of some off-Base groundwater contamination that was traced back to a source located on Base. And once that designation was established, further studies were performed.

And we initially started out with a formal list of IR sites that had to be addressed. And there was a federal facilities agreement cosigned by the regulatory agencies and Department of Defense representatives obligating us, the Navy, to stick with this remedial program until all these sites were addressed, addressed to the satisfaction of the community and the regulatory agencies.

And at Site 16 is one of those initial installation, IR -- Installation Restoration Sites that was identified. We then moved into the remedial investigation. That's where we tried to find out okay, what exactly do we have here, let's do our studies, our sampling, our analysis, what type of contaminants do we have there, and trying to pin that down.

Feasibility study, okay, we know what's there. And now, what do we do with it? How do we treat this? How do we resolve this issue?

That brings us up to tonight, the Proposed Plan. This brings us up to this process as to getting the true public opinion, as to what their opinion is at this point.

I'll turn it over to Marc Smits. And he can walk you through, in greater detail, what's happening at the site in the form of a historical perspective.

MR. MARC SMITS: I'd like to start with a bit of background on Site 16. The site was used for firefighter training activities from about 1972 to 1985. And the site basically consists of three pits, which are depressions where they used to do the activities. And what they wanted to do was to simulate a crash out there and have the firefighters come out and put it out. So what they would do is they would fill this depression with water. They would put fuels and, also, some waste in that mixture, ignite it. And then, the firefighters would come out and actually put out the fire. And that's basically the process.

One important note is that the pits are unlined, so they're basically just soil. And that's basically where our problems come in, contaminants can then move downward.

From our investigations, we have found that TCE or trichloroethene, an industrial solvent, is our main contaminant. And it's present in the groundwater. So it has moved from the surface all the way down to the groundwater.

And the acronyms that we'll be talking about today, like TCE, are listed in the back of your presentation, so if you want to reference those. Also, we have provided in the Proposed Plan, on Page 5, a list of chemical and technical terms. And these are all related to Site 16.

The site map gives you an indication of where the site is actually located. It's in the approximate center of the former MCAS El Toro.

And as I said before, there are three pits out there. But the main one they worked in was this main firefighting pit right there. (Indicating.)

And that's where most of the contamination is coming from. The shaded area there is the area that we have identified as the TCE plume area.

Based on the use of the jet fuels and, also, the mixed wastes out there, the Navy decided to initiate a remedial investigation in 1993. And that consisted of collecting soil and groundwater samples at various depths. And the results from that were used to determine whether we needed to do any further action out there so that's basically the first question that we need to answer, do we need to do anything further.

As part of this, we conducted a risk assessment. And the risk assessment is basically evaluating the potential of the health problems that may occur from the contaminants that may remain in the ground or in the groundwater. And we do have a further explanation on risk assessments in the Proposed Plan, on Pages 6 and 7.

What did we find from our investigation?

We found that for the most part, we do have volatile organic compound contaminants. The main one we found was the TCE all the way from the ground surface down to the groundwater, which is about a hundred and thirty feet below ground surface.

We also found semivolatile organic compounds, polynuclear aromatic hydrocarbons, petroleum hydrocarbons and metals out there. And of these, the petroleum contaminants -- What we've done is we've moved those into a different program called the Petroleum Corrective Action Program, and they're being addressed under that program. And one of the key points to point out about that is that we didn't find petroleum products or contaminants in the groundwater.

For the groundwater, we did find that TCE was in the plume. It was relatively within the same area as the main pit. And with the groundwater level starting at about a hundred and thirty feet, we did find the TCE was detected at a depth of about thirty feet from there. The lateral extent was about five hundred feet in length and two hundred feet wide. The highest concentration that we found in the groundwater, to this point, is four hundred micrograms per liter. It's also expressed as parts per billion. And that's important, because the maximum contaminant level that's been established for TCE in drinking water is five. So you can see we're obviously above that, at this point.

Based on the results from soil and groundwater, we were able, then, to make some determinations as to what we would recommend for the various soil and groundwater zones.

The shallow soil, which is from zero to ten feet below ground surface, we recommended for no further action.

The deeper soil, which extends from ten feet all the way down to a hundred and thirty feet, we recommended further action.

And the groundwater, of course, seeing that it has TCE in it, we recommended for further action.

The recommendation for no further action at shallow soil comes from the results of the risk assessment that we conducted out there. It did find that there was a very low potential for those remaining contaminants to pose a threat to the public. So based on that, we were able to recommend no further action for that area.

For the deeper soil, the concern was that the contaminants that remained in there could potentially still migrate down into the groundwater and be a continuing source to the groundwater. So we have to address that, in that respect.

And then, for the groundwater, it's that we need to address it because it is above that maximum contaminant level of five ppb.

I'm going to pass the next part of the presentation on to John Scholfield, who's going to go through the feasibility study, as well as the alternatives that we've looked at within the feasibility study.

John.

MR. JOHN SCHOLFIELD: Thanks.

As Marc just pointed out, the remedial investigation recommended further action for soil from ten feet below the ground surface, down to the groundwater, and action for the groundwater.

And as a requirement, the Navy prepared a feasibility study. A feasibility study evaluates remedial technologies that are applicable to the site contaminants and conditions and provides information for decision-makers, which is the Navy and the regulatory agencies and the input from the public, to select the most appropriate remedial alternative for the site.

Now, for Site 16, there were three phases for the feasibility study. The first was the draft feasibility study, which was conducted from 1998 to 2000. And then, there was a pilot study from 2000 to 2001. And then, there was a final feasibility study conducted from to 2001 to 2002, which brings us up to right about now.

The draft feasibility study alternatives address the VOCs in deeper soil and groundwater, which it utilized the presumptive remedy multiphase extraction technology to address VOC contamination. Presumptive remedies were developed by the EPA to streamline the cleanup process, where they found that certain technologies had a good chance of being successful with certain contaminants under certain conditions. So at Site 16, it was appropriate to utilize the presumptive remedy of multiphase extraction to address the site, because it addresses VOCs in soil and groundwater.

And the draft FS recommended a pilot study to evaluate this technology at the site. Henceforth, a multiphase extraction pilot study was conducted. And the objectives of the study were to determine site-specific effectiveness of this technology and to provide technical information for a full-scale system at the site.

And where would we be in a presentation without, hopefully, a pretty picture?

This is just a representation that's not so good on here, but maybe it's a little better in your handouts there. But the picture on the left is the groundwater -- posttreatment groundwater storage from the extraction system. That's on the right. And on the right photo, the left part of the photo is the groundwater extraction system -- groundwater extraction and treatment system. And then, this is the vapor treatment system.

Okay. What did the pilot study accomplish?

Well, it was very successful in removing the VOCs from the soil. It removed a hundred twenty-seven pounds of VOCs.

And it reduced the VOC concentrations in the soil to levels that are unlikely to load groundwater to the maximum contaminant levels.

However, it wasn't effective in cleaning up the groundwater.

So aren't we glad we did a pilot study to figure that out?

Now, this is a diagram that's present in your handouts and in the Proposed Plan. And it's just a representation of the site prepilot study and postpilot study.

And you could see in the slide on the left, that there is VOC contamination in the soil. And on the left, it's removed. And you can see that there's still contaminated groundwater out there, because the system wasn't effective in addressing the VOC-contaminated groundwater.

Okay. So we utilized the results from the draft feasibility study and the pilot study to develop the final feasibility study. And this presents the final cleanup objectives and remedial alternatives.

And the final remedial objectives were to protect the public from the contaminated groundwater, to minimize the migration of the contaminants in the groundwater, and confirm the results of the pilot study which showed that the VOCs were removed from the soil.

The final FS presents three alternatives for the site:

One is Alternative 1, which is the No Action Alternative, which is required as part of the FS to compare with the other alternatives.

Alternative 2, which is the preferred remedy in the Proposed Plan. And that's monitored natural attenuation with institutional controls. And that relies on natural processes in subsurface, which reduce the contaminants in groundwater over time.

And then, the third one was the downgradient water extraction with institutional controls. And that utilizes downgradient groundwater extraction to control the plume.

Alternative 1, as I said before, is no action. It is a baseline to measure the other alternatives. And no action is taken place to monitor the groundwater, or anything.

Alternative 2, which is identified as the preferred alternative, utilizes natural processes to remove the chemical compounds over time, includes groundwater monitoring to verify that is what is going on at the site. It includes soil vapor monitoring to confirm the results of the pilot study that all the VOCs were removed. It has site grading.

The reason the site grading is in there is actually the main pit, where almost all the contamination at the site was introduced into the subsurface, it is still a depression out at the site. So as part of the alternative, we're going to fill that in, just to prevent any extra infiltration that would take place in that area.

And then, we have institutional controls as part of the remedy. And that prevents public use of the groundwater beneath the site that's contaminated and gives provisions for site access to monitor the site.

And the third alternative, Alternative 3, utilizes downgradient groundwater extraction to control the plume. It also includes the groundwater monitoring, the soil vapor monitoring, and the site grading. It has the same institutional controls to prevent the people utilizing the groundwater and for site access. So it basically has a system on the site that treats the groundwater that's extracted.

And then, here, this is a table that's also present in the Proposed Plan. And this just presents the cost associated with each of the alternatives.

And the No Action Alternative doesn't have any cost, because there's nothing going to be done out there.

And then, of the other two alternatives, Alternative 2 is the least expensive of the alternatives that are protective. And most of the costs associated with Alternative 2 are monitoring costs.

And Alternative 3, which I said is more expensive, a good portion of its costs are capital costs for developing a system to put up on the site.

And at this point, I'd like to turn it back over to Marc. And he'll go over the rationale for the preferred alternative.

MR. MARC SMITS: Thanks, John.

So how did we come to choose Alternative 2 as our preferred remedy?

Well, there's a very established process where a comparative analysis is done. And it's done by using nine established U.S. EPA criteria, so we can look at all the alternatives and determine which one would be the best for our site.

The first two are overall protection of human health and the environment; and then, also, compliance with applicable or relevant and appropriate requirements. That has to do with the regulations that would apply for the site and for these alternatives. As you can see, for Alternatives 2 and 3, both of those meet that criteria. For long-term effectiveness and permanence, both Alternative 2 and Alternative 3 are rated highly. And that's based on both of those eventually reaching the cleanup goals for the site.

When it comes to the reduction of contaminants, Alternative 3 was rated higher than Alternative 2. The main reason for that is you are actually removing the groundwater, the contaminated groundwater, from underneath and treating it aboveground. And in the case of Alternative 2, it's the natural processes that are occurring underneath in the groundwater.

Short-term effectiveness and implementability, you can see that Alternative 2 is rated higher than Alternative 3, the main reason being there's not a lot of work in establishing a monitoring program when you compare it to having to design, construct and operate a treatment system, which is what you would have to do under Alternative 3.

One other factor that comes into play with those two is with Alternative 3, you actually have to bring the contaminated groundwater to the surface. And that increases the potential for workers and, also the public from coming in contact with contaminants; whereas Alternative 2, everything's happening underground, and the public is protected because they are not exposed to the groundwater.

As John mentioned the costs, Alternative 2 is the less costly of the two.

State acceptance, we do have acceptance from the State as this being the preferred remedy.

And for community acceptance, that's in progress right now. That's what we're doing right here.

Any of your comments or questions will be taken into consideration when we are looking at the Record of Decision that we're developing.

Okay. The rationale, why did we pick Alternative 2?

Again, just want to emphasize that this is protective of human health and the environment. And that's one of our main goals in site cleanup.

Second is that through the monitoring, we will be able to detect whether the concentrations are decreasing over time, basically whether the natural attenuation or the natural processes are working. Soil vapor monitoring will address the deeper soil that has some remaining contaminants and just ensure that those aren't continuing to bleed into the groundwater. It is the least costly of the two alternatives, Alternative 2 and Alternative 3.

We will be conducting five-year reviews, as well as annual reviews, of the monitoring results. And this is to evaluate the effectiveness of the remedy. You know, you really want to keep an eye on it and make sure that it is meeting those remedial action objectives or site objectives that we've established.

And then, finally, when implementing a monitored natural attenuation remedy, it's a requirement for us to have a contingent remedy just in case the first one doesn't meet the goals that we have set for it. So what we have done is we've chosen Alternative 3 as the backup remedy at the site.

This figure just gives you a look at our conceptual design for the monitoring out there under

Alternative 2. As you can see, we have a background well that we would use to monitor, make sure that there are no other contaminants coming from off-site.

We have wells within the most contaminated area, as well as just downgradient from it, so we can see from that whether or not the natural processes are working. And then, we do have -- Or, we will have wells further downgradient. And that is kind of an indicator on the movement of the plume. If it moves, that's the well that's going to tell us. And then, we can make appropriate decisions from there.

I'll turn it over to Dean, to just give us a little more information about the preferred remedy.

MR. DEAN GOULD: Thank you, Marc.

I had mentioned the term BCT earlier, BRAC Cleanup Team. It is, very much, team approach. But that's not to say that each of us doesn't have a very unique role as a part of the team and perform a very important function on it.

The Navy, we're the ones responsible for actually implementing, executing the remedial program.

Regulatory agencies have a very key oversight role to make sure that things are done in accordance with all the appropriate regulations and according to the guidance that they've put out.

So at this point, the BCT, the team, has reached concurrence on this preferred alternative. However, that was not without a great deal of interaction and discussion to get to this point, which is what you folks are paying these agencies to do. So I think you should feel proud for the role that they played on this site.

But I do want you to hear from them individually, to hear their perspective. And they can better define what their role is with respect to this process.

So we'll start with Nicole Moutoux with U.S. EPA.

MS. NICOLE MOUTOUX: I'm going to stand here. If you can't hear me, then tell me to yell.

So, my name is Nicole Moutoux. I work for the U.S. Environmental Protection Agency in the Region 9 office, which is based in San Francisco. I work in the SuperFund Division as a project manager for military SuperFund sites.

Just as a side note, I used to work on Tustin, the Base up the road. So that was my last gig.

So a little bit about my role on the Base Cleanup Team, as Dean mentioned, Marine Corps Air Station El Toro is on the national priorities list of

SuperFund sites. And that makes EPA the lead regulatory agency on the team. That means I, as a project manager for EPA, am tasked with ensuring that the decisions that the Navy proposes meet all the regulatory requirements under the SuperFund laws, as well as protect human health and environment.

It also means because the site is on the NPL, I have access to the experts in my office in fields such as a toxicology, hydrogeology, radiation, landfill, et cetera. And so, these people review the relevant portions of work plans and documents that the Navy develops. And then, I sit with them and we talk about our concerns. And that's what I bring to the team. So it's not just me reviewing it. It's other people with other expertise.

I thought it would be helpful to just provide a site-specific example of the kind of input that I've brought to Site 16. And that is an earlier proposal for the remedy at Site 16 was groundwater monitoring with deed restrictions, institutional controls. The Navy felt that they could show with the groundwater monitoring that the plume was either remaining stable or dissipating. So after reviewing their data with -- with our hydrogeologist, Herb Levine, who's actually worked on El Toro much longer than I have -- Some of you may remember him -- we agreed that based on the historical data, as well as the modelling that the Navy conducted, we suggested that the Navy consider the natural attenuation remedy. That, in conjunction with the fact that the source has been effectively removed in the soil, we felt that they could show that natural attenuation was occurring.

And in addition to that, EPA has developed some very detailed guidance for the type of monitoring that's needed for this remedy, as well as what to monitor for and how to evaluate the monitoring results.

In addition, this remedy, under the guidance, requires that a backup remedy, as Dean and Marc have mentioned, is selected at the same time in the Record of Decision, so that in the event that the monitoring results show that the plume is not decreasing as the modelling had predicted, we can move straight to the backup remedy without going through a big selection process.

So, you know, after discussions with the team, this is what we have here today. And as it is now, EPA concurs with this remedy.

MR. DON ZWEIFEL: Can I ask something?

Oh, we have to wait.

MR. DEAN GOULD: And welcome, Don.

MR. DON ZWEIFEL: You know, there are others who don't believe in natural attenuation or biodegradation.

MR. DEAN GOULD: And the next person I would ask to speak would be Ms. Chesney, with DTSC.

MS. TRISS CHESNEY: My name is Triss Chesney, and I am the project manager for MCAS El Toro, representing the Department of Toxic Substances Control, or DTSC. DTSC is one of six departments under the California Environmental Protection Agency.

And John Broderick represents the California Regional Water Quality Control Board, or Regional Board, which is also affiliated with Cal. EPA.

As the DTSC project manager for MCAS El Toro, my responsibility is to ensure that the activities and decisions for Base cleanup meet the requirements of State environmental laws and regulations. Our overall goal is protection of human health and the environment.

So to accomplish this, I review documents prepared by the Navy, participate in meetings, visit sites, and provide oversight of field activities.

As part of my review, I obtain input, like EPA does, from technical specialists, such as geologists, toxicologists, engineers, attorneys, public participation specialists. I consolidate their input with my own and share our concerns with the cleanup team that consists of the Navy, EPA, DTSC and the Regional Board. In some cases, I also coordinate review with other departments within the State that have specialized expertise so they can provide input to the cleanup process. These don't specifically relate to Site 16. However, they do relate to other sites.

For example, the Department of Health Services has expertise in radiological issues. And the California Integrated Waste Management Board has expertise on landfills.

For Site 16, vadose zone monitoring is a specific example of how DTSC input was incorporated into the preferred remedy. Vadose zone monitoring consists of sampling and analyzing soil gas drawn from the open spaces around the soil particles in the soil that's above the groundwater.

As previously mentioned, the Navy completed a pilot study that effectively removed volatile organic compounds, or those compounds that readily evaporate, from the deeper soil. So as a result, the Navy recommended no further action for the deeper soil.

Our concern was that there may be compounds stuck in the tighter soil, such as clay, that would slowly evaporate into the soil gas and recontaminate the deeper soil. And we were also concerned that the deeper soil could be recontaminated by compounds evaporated from the groundwater that hasn't been cleaned up.

So after our discussions with the team, and in response to our concerns, the preferred remedy now includes monitoring of the soil gas in the deeper soil, also known as the vadose zone. And the purpose of this monitoring is to demonstrate that chemical concentrations in the soil gas do not increase due to evaporation of compounds from either the clay soils or groundwater and to verify that this deeper soil had been cleaned up.

So since our concerns were addressed during development, DTSC concurs with the preferred remedy of monitored natural attenuation with institutional controls.

MR. DEAN GOULD: Thank you.

Home stretch, this just outlines some of the benefits of the preferred remedy. Although they've been better articulated during the more technical portion of the presentation, these just summarize some of those. And you have them in your handout, as well.

So, what is next? Where do we go from here?

I mentioned the time frames for the Public Comment Period. They're also listed on the front of the Proposed Plan itself. Once again, we need that input.

Then, we'll go to Record of Decision and Responsiveness Summary.

The Responsiveness Summary would be responses to the various questions that are posed to us. You can follow the time line that's also in the Proposed Plan here to see what the steps are. And then, we'll get into the remedial design for the treatment of the groundwater.

And then, we take action. We implement that remedy. And then, we have to get into the monitoring to make sure that that remedy that we've put in place and executed was, in fact, effective in remediating the site.

That is the end of the second phase of our presentation this evening. At this point, what I'd like to do is open up the floor to you, to the audience, to pose any questions that you would like to have formally registered with our Court Reporter on anything you've heard tonight, or any questions you may have brought into the room with regards to our approach at Site 16, or just the site in general.

This is just one of those byways to provide information.

Yes, ma'am.

First, if I might ask if you could please state your name so that the Reporter may record that.

MS. LINDA GRAU: Yes. My name is Linda Grau, and I'm a candidate for Irvine City Council.

You have mentioned, the group of you, different aspects of the Base that need cleanup. One of them is the depression that the firefighters used fuel and water. And then, in some of the reading material, I saw here there was ordnance that needed to be cleaned up. I imagine that would be leftover bombs, and bullets, and that kind of thing. And then, something else was mentioned about petroleum with a different program.

Is all that you're doing here just for the depression that had the firefighters working in it, or is it comprehensive of all the programs?

MR. DEAN GOULD: Mm-hm. Okay. Very good question, very thorough question. And we'll definitely prepare a comprehensive response to that. Thank you.

Mr. Zweifel.

MR. DON ZWEIFEL: Well, you all know how I stand.

Well, you know, when Joseph Joyce was, you know, the BRAC Environmental Coordinator, he said Don, I've just been to a special presentation, a symposium down in Texas, I believe it was -- And maybe you guys went, too -- on natural attenuation. He said it's the best thing since sliced bread. Of course, on the prima facie, on the surface of it, it seems well, maybe it is a good idea.

But the thing is, then, we look at another factor. We always have wanted, from the get-go -- at least, I have; and I think others in this room, maybe -- clean closure. But it's something that the Navy -- the Department of the Navy may not want to hear. But then, you know, you guys are regulators.

And I know I'm asking a lot. We're asking a lot. But the question is, you know, consider clean closure. And I know that that sounds like, you know, costly. However, you know, there are ways to expedite these matters.

For instance, the -- As far as the landfills are concerned, we could have excavated these landfills. And then --

MR. DEAN GOULD: If we could limit it.

MR. DON ZWEIFEL: I just wanted to give input.

I want to know why we couldn't have excavated, you know, the landfills.

Let me know.

MR. DEAN GOULD: We really need something related to Site 16.

MR. DON ZWEIFEL: Chuck did say that he felt that some of the landfills would be more cost-effective. The cost benefit ratio would be higher if we just excavated it, maybe process it on-site.

MR. DEAN GOULD: Mr. Zweifel, what is your question with relation to Site 16?

MR. DON ZWEIFEL: The question is: What do you think about clean closure?

MR. DEAN GOULD: Okay. Thank you.

Mr. Werner.

MR. JERRY WERNER: Jerry Werner.

As I was talking with Marc before the meeting, what does the curve of concentration versus time look like for natural attenuation in terms of your Table 4 which you have your data? When was that data taken?

MR. DEAN GOULD: Very good question. Thank you.

Questions.

MR. ROB MEAD: Rob Mead, M-e-a-d.

Related with Site 16, you mentioned in here that the VOCs were removed down to a depth of a hundred and thirty feet, I believe was the depth that was given.

How exactly were those removed?

MR. DEAN GOULD: Okay. We'll be glad to answer that.

MR. ROB MEAD: I'm just curious. I'm just curious why these questions can't be answered tonight.

MR. DEAN GOULD: They can. During the poster board session, that would be a perfect time to --

MR. ROB MEAD: But I didn't know that.

MR. DEAN GOULD: After this time, when you get with the representatives, we'll be glad to answer that. But when the Court Reporter is taking these official comments, we need to provide an official response to you.

MR. ROB MEAD: Okay.

MR. DEAN GOULD: So, please, feel free to ask the question to one of us again. And we'll also be obliged to provide it.

Yes, sir. Your name, please.

MR. LARRY LAVEN: My name's Larry Laven.

I was just curious as to TCE. I'm not really a chemist. There's a lot of complicated -- Is that the same chemical that's in the groundwater plume that they're going to use vapor extraction?

This is a little contaminated site -- Right? -- compared to where they were washing the airplanes by the hangar?

Is that the same chemical in the water, both places?

MR. DEAN GOULD: That, I can answer.

Yes, it's one of them.

MR. LARRY LAVEN: I just have a comment on this, though. From looking at this, I get the idea that this is a very small area, and that the -- I also saw this when we drove by. And the plume, I have a feeling, is small underneath it and not really going anywhere.

And, scientifically, I have learned to study things from extreme angles fist. You look at something at one angle of an extreme, and then you take something out at another angle. This is small.

And to see what natural attenuation would do, you might as well try it here, where you could do something. Because on a grander scale, yeah, where are you going to compare it to, where you can set up this stuff and do all kinds of stuff; right?

What could you compare it to where you had done less to see what the difference is?

It might be interesting, you know, something to compare a different, you know, natural attenuation. Like, yeah, he's concerned about clean closure.

But what if all this stuff doesn't work for something we don't see in the end, anyways?

MR. DEAN GOULD: Okay. Thank you.

MR. MICHAEL BROWN: Michael Brown. I'm a consultant with the City of Irvine. A few questions.

First, the City is working with the Navy to develop a Reuse Plan. That assumes that excepting the landfills, there will be unrestricted use of all the surface property.

And will that also be the case at Site 16?

You mentioned institutional controls specifically around areas of groundwater.

But will there also be institutional controls specifically restricting any surface activities on the site?

And that also -- Related to that is if there is in reuse, which is that particular area's current configuration, the Reuse Plan contemplated to be -- I'll say a general open space, is any grading -- would any grading be allowed at that site, either additional soil or any soil removal?

So that's one issue.

Second issue is what kind of restrictions are being contemplated for protection of the monitoring wells?

How many monitoring wells are being contemplated?

What kind of access will the Navy and regulatory agencies need, both in terms of physical access and any contemplation of barriers that need to be a certain distance via any kind of construction or landscaping?

If that particular area were to be landscaped and irrigated, is that a problem, from your perspective?

Also related to Mr. Werner's question about the attenuation curve, if using natural attenuation, if this is a case of basically letting dilution bring levels of TCE below the MCL, what is the dilution rate?

Because it's not in the Proposed Plan.

And can you explain for us if that rate is -- that dilution rate is not being met, is that what is going to trigger the use of the contingency alternative?

Or, what exactly will trigger the use of the contingency alternative?

And then, are there any other -- If the alternative is implemented, what kind of institutional controls will be associated with that?

Will there be additional restrictions on surface uses because of the existence of a pump and treat activity?

And I'll leave it at that.

MR. DEAN GOULD: Thank you.

Perhaps Dr. Brown's questions very well illustrate why we don't try to answer all questions, because it is important for us to give detailed responses. And they become a part of our Responsiveness Summary that actually goes into our Record of Decision.

Thank you.

Yes, sir.

MR. BILL PRESTON: Bill Preston, with Pres-Tec.

My understanding of the two alternatives that have been selected is that the preferred one would cost two million dollars and take nineteen years in the process. The backup plan, I don't really know what the time line says that would take, but it would cost three million dollars.

The question is: If there were a proven technology available, new technology, is there a process, a speed-up process, that they can go through that would evaluate and either pass or fail that new technology within a period of time that could, you know, make it still evaluated here?

And just as an aside, the new technology in this case, I believe, could completely clean up that TCE spill within a year and at a cost of less than a million dollars.

So is that of interest to the Navy, to the City of Irvine, to the various regulatory agencies, et cetera, et cetera? Is that of interest to pursue that?

Possibly taking a little more time in making the final decision, but also possibly saving a million dollars and, ultimately, maybe as much as eighteen years in the cleanup process.

MR. DEAN GOULD: Okay. Thank you.

MR. DON ZWEIFEL: Well, you know, let's look at Alternative 3, for goodness sake, regulators. Please, consider this. Let's look at this real quick. It looks like Alternative 3, downgradient extraction, would be a better idea. And the reason why I'm saying this is because -- Well, I mean, the idea is we don't want to wait forever. And it seems like this would be a more expeditious way of remediating the problem. So let's think about it for a moment.

And I wanted to ask --

MS. LINDA GRAU: Why are you going back to 3, when 4 is so much more attractive?

Bill Preston just suggested something that would take one year and less than a million dollars.

MR. DON ZWEIFEL: I'm coming in at -- you know, a bit late. So maybe Alternative 4 is -- I was just giving it a cursory glance. And it appeared Alternative 3 is -- However, maybe she is right.

However, there is a problem. And we have a problem. And that problem is we have the groundwater subbasin is being depleted.

MR. DEAN GOULD: We have to go back to Site 16.

MR. DON ZWEIFEL: What I'm referring to is recharge. We have to recharge the groundwater basin.

And here, the question is -- You may not think it's important, but it is important. We've just -- The Orange County Water District just determined that our groundwater subbasin is in dire straits. We've been depleting it.

MR. DEAN GOULD: Your question.

MR. DON ZWEIFEL: And so, the question is whether this would impact detrimentally the -- well, the drought -- I mean, will it affect the drawdown?

And if it will affect the drawdown, to what extent?

Will it augment the drawdown?

If it does, we've got a problem here. We need our groundwater. When we draw down --

MR. DEAN GOULD: Your question is will it affect the drawdown?

MR. DON ZWEIFEL: Will it be depleted to the point where it can't -- It's the permeability factor? Right?

We talked about that. Once those clay layers have been -- Once you've extracted the moisture from those clay layers, then they lose their permeability forever.

MR. DEAN GOULD: Thank you.

MR. JERRY WERNER: I notice we're a little late in this meeting.

How do you want to handle it?

MR. DEAN GOULD: I would suggest we continue, if the RAB does not mind, until the questions have been fielded during this portion.

And then, also, I would suggest rather than transitioning to the other room, if the RAB members don't mind and, also, our visitors that don't typically come -- I'm delighted to see new faces tonight. You've got a golden opportunity to get two for one tonight, to attend a RAB meeting, which many of you have not attended before. You're welcome to stay in this room.

But to answer your question, Mr. Werner, I suggest that we complete the fielding of formal questions, take about a five-minute break, and then start the RAB meeting right here.

Any more questions or comments?

Terrific. Thank you very much.

Let me ask especially for those that have posed questions, but also important for everyone that's in attendance tonight, please be sure you sign up on the sign-up sheet, so we can get these responses in the mail. We want to make sure they're responsive to you, since you've invested your time tonight.

It's 7:35. We'll start the RAB meeting at 7:45. In that exchange period, you're welcome to either write down additional questions, take forms with you, pose questions directly to the Court Reporter, or ask questions of any of the staff that's here tonight.

So thank you very much.

(Conclusion of proceedings at 7:45 p.m.)

REPORTER'S CERTIFICATE

THE UNDERSIGNED CERTIFIED SHORTHAND REPORTER DOES HEREBY DECLARE:

THAT THE FOREGOING WAS TAKEN BEFORE ME AT THE TIME AND PLACE THEREIN SET FORTH AND WAS RECORDED STENOGRAPHICALLY BY ME AND WAS THEREAFTER TRANSCRIBED, SAID TRANSCRIPT BEING A TRUE COPY OF MY STENOGRAPHIC NOTES THEREOF.

IN WITNESS WHEREOF, I HAVE SUBSCRIBED MY NAME THIS DATE: NOV 13 2002.

Jeanine Burgner

CSR NO. 6653